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A N
INTIRE SYSTEM
O F
Arithmetic:

O R
Arithmetic in all its Parts.

CONTAINING

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|-------------------------|---------------------------|----------------------------|
| I. <i>Vulgar.</i> | IV. <i>Sexagesimal.</i> | VII. <i>Lincol.</i> |
| II. <i>Decimal.</i> | V. <i>Political.</i> | VIII. <i>Instrumental.</i> |
| III. <i>Duodecimal.</i> | VI. <i>Logarithmical.</i> | IX. <i>Algebraical.</i> |

With the Arithmetic of Negatives, and Approximation
or Converging Series.

The Whole intermix'd with *Rules New, Curious, and Useful,*
mostly Accounted for in the *PREFACE.*

The *Algebraic Part* is rendered more *Plain* and *Easy* than hath been done, by Instructive Rules and Examples *Literally* and *Numerally*, in a *Method New*: Solving Equations, Simple, Quadratic, Cubic, &c. several ways.

And in the proper Places of this Work are *An Accurate Table of Logarithms* to 10000, and Rules to find those to 1000000000, and Natural Numbers to such Logarithms; with *the full Use of the Table* in Multiplication, Division, Involution, Evolution, and in the Solution of *all Cases of Compound Interest*, of which there are 24 Large and Exquisite Tables, (and one for the Valuation of Church or College-Leases of their Land) as also those of *Simple Interest and Discount*; with a new Method of finding the latter, and the present Worth of Money for Days.

Also Ample Definitions and Explanations of Numbers, Quantities, and Terms used in all Parts of Arithmetic, in Alphabetical Order; rendering the Whole more Intelligible, and the Easier Learned.

With an APPENDIX, shewing the Mensuration of more Superficies and Solids, than any Book wrote purposely on that Subject has exhibited.

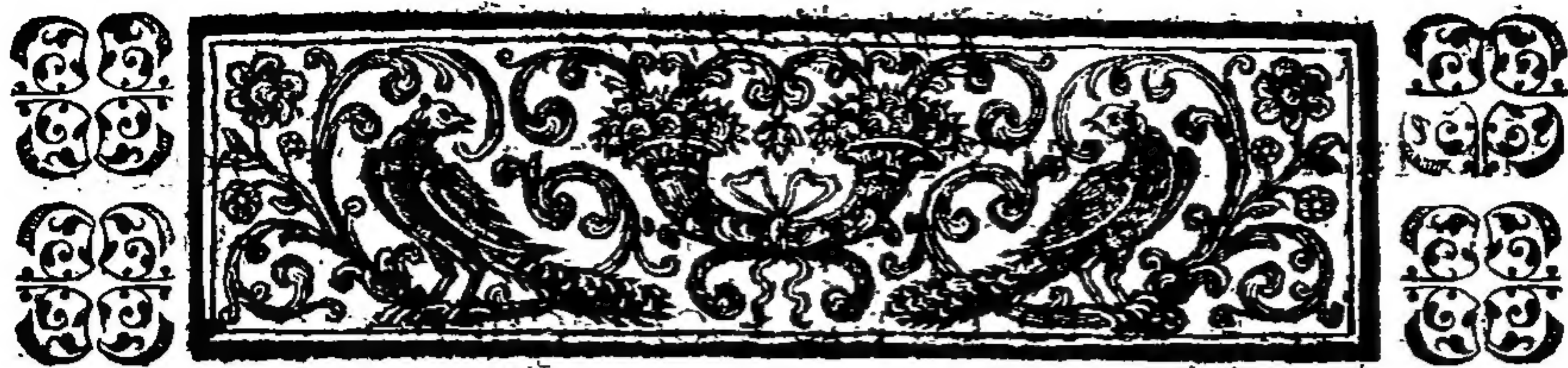
This TREATISE, for Copiousness and Novelty of Matter and Method, far exceeding the most Perfect Arithmetic extant.

Necessary for all who would in a short Time, and with little Study, acquire a competent Knowledge of Numbers and Species, or would make any considerable Progress in the Mathematicks.

Written by *EDWARD HATTON* Gent.

L O N D O N, Printed: And sold by Mr. MOUNT and Comp. on *Tower-Hill*; Mr. STRAHAN and Mr. SIMON in *Cornhill*; Mr. KNAPLOCK, Mr. KNAPTON, and Mr. HOLLAND, in *St. Paul's Church-yard*; Mr. BROWNE, Mr. MEARS, and Mr. VALENTINE, by *Temple-Bar*; Mr. KING, in *Westminster-Hall*; Mr. CLEMENTS, at *Oxford*; and Mr. CROWNFIELD, in *Cambridge.* 1721.

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To the Learned

Dr. JOHN KEILL M.D.

*Fellow of the Royal Society, and Professor of
Astronomy in the University of Oxford.*



REATNESS and Goodness (you know, Sir) compleat the Rational Specie: By Greatness I mean true Magnanimity embelished with Learning and Science; by Goodness I suppose such a one as above, finished with an humble condescending communicative Temper or Disposition: And by how much any one excels in the former, by so much he is to be admired for the latter Endowments. I need not tell the World how much the Qualifications and Acquirements of the first kind are yours, Sir: Your Learned Treatises of Philosophy, Astronomy, &c. in another Language, are sufficient Indications of that: And for the other, I have experienced your Condescending, Generous, and Diffusive Goodness, not only in your giving me an Opportunity of being known to you; but by

the many Favours in so short a time received from you : which propitious Providence having so ordered as to be the Consequence of my writing the following Book, I could neither justly nor naturally think of Dedicating it to any but Yourself.

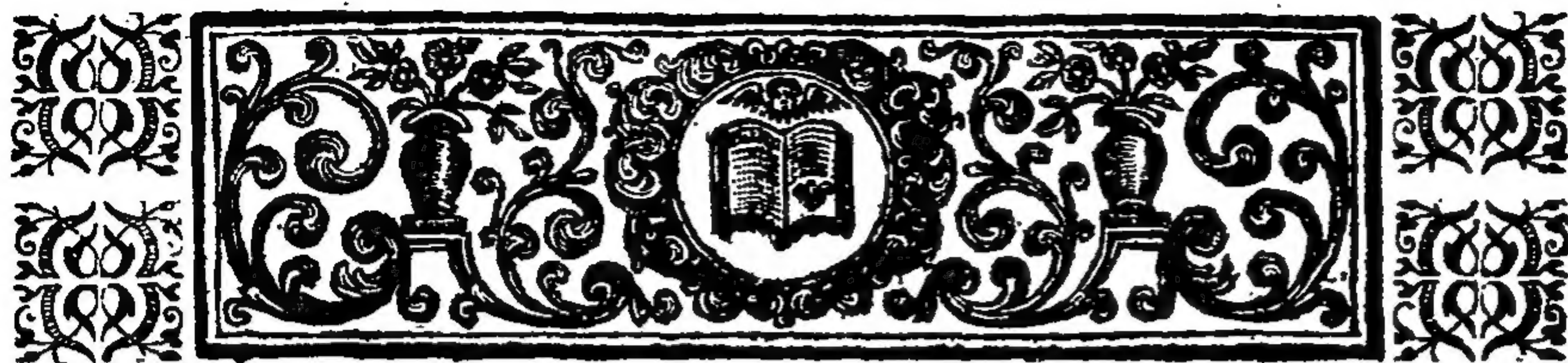
And altho I am far from having intended this Treatise for the few of your Superior and Universal Genius; yet I am not without hopes, but that upon an impartial and particular Perusal, even such as you may find some things Novel and Acceptable. And as for those who have not, but are desirous to acquire the Knowledge of Arts Mathematical, (a Study so exceeding Pleasant and Useful) I have endeavoured to guide them at least to the Entrance of that large and unfrequented Path in which you and some others of your most Illustriously Learned Royal Society have made so vast a Progress.

The Preface enumerates some of those many Things which I take to be New, and not contained in any other Treatise of Arithmetic in our own Language : And for what is in others, I know you are a much better Judge than,

S I R,

Your Obligated and most Humble Servant,

Edw. Hatton.



T O T H E

R E A D E R.



HAVING for many Years past spent my Leisure Hours in Mathematical Studys, and not meeting with any Treatise teaching in a Succinct Order, and Good Method, all the Parts of Arithmetic; and having made Emendations and Improvements in most, and investigated and discovered things new in many others: I supposed the Publication thereof would be accordingly received by the Studios in

this Art. But to be a little more particular, I have by way of Introduction inserted very Useful and Copious Definitions of Numbers, and Explications of Terms Arithmetical, which will admit of the Whole being easier understood and sooner learnt. I have next given the most Large and plain Numeration-Table; and Tables and Rules to assist the less knowing in Addition without Pricking and Carrying; and how to add Money, Weight, Measure, &c. by one Rule: Also Tables of Weight, Measure, &c. in a more accurate Method, and more various than others: The Reason of the Way of Working in Substraction and Multiplication; and in Multiplying by several Digits, I have given the Reason why the Products of all from the first are put one place more towards the left hand: Also a large Table for Beginners, and a new brief one of my own contrivance for the more Skilled. In Division I have shewed four several Ways,

Ways, with the Reason of the Method of Operation, and how to find all the even Parts of any Numbers, which is applied in finding the Aliquot Parts of a Pound Sterling, &c. And besides the plain and best Way of Extracting the Square and Cube Roots of Numbers, I have given Rules how to do that of the Biquadrate by an Example altogether New, and must be esteemed Curious, especially to those who are not acquainted with Algebraic Canons. In Progression you have several things not to be found in other Books of this Subject; as Rules to find the Total of a Series produced by different Factors, and of the Charges to be rang on any Number of Bells, &c. with the Reason of the Abstruse Rules for finding the Totals of Series's, whether the Ratio be Arithmetical or Geometrical: And have recommended this Part of Arithmetic to the Learner's Perusal, and not to be passed over, as is too common both in Books and Schools. And whereas others on this Subject give but four, or at most five kinds of Rules of Proportion, I have in this Treatise exhibited Twelve. The Rules of Practice are far more Numerous, Brief, and Methodical, than any done by another Hand: And here are many things more than common in Fellowship, as three several Ways of answering Questions, &c. as also in Alligation, Barter, and Equation of Payments.

In Decimal Arithmetic (besides the Hint given of a New Specie thereof) you have so many things truly Novel and Curious, especially in Reduction and Multiplication, as would be too prolix to enumerate; where you will find some Answers exhibited by short and accurate Methods quite contrary to the General Rules given for Addition and Subtraction; i.e. By Adding and Sultracting one and the same Number, as Units to Tens place, &c. and the contrary.

And in the Use of Decimals, besides the Way of answering any Question by Decimals as exactly as by Vulgar Fractions (which to me is wholly new) you have the only Genuine Tables of Discount that I know extant, with a New as well as more Brief and Easy Method of Computing both Discount and Present Worth of any Sum for Days, (so much practised by Traders) the Foundation of which you will find in Algebra, Chap. 10. I have next shewed the Arithmetic of Duodecimals and Sexagesimals; the former used in Mensuration of Superficies and Solids, the latter (chiefly) in Astronomy, whence called by some Astronomicals: and these I have done in a new plain Method, and for the more difficult Cases. As to Political Arithmetic, I have said enough to shew its Nature and Manner of Process to discover what is required, illustrating the same by Examples, and have referred to others who have purposely and wholly treated thereon. In Logarithms I have omitted nothing that I could find necessary or deficient in other Authors; and believe I may with Veracity affirm, That no Book
of

of Arithmetic affords so ample and plenary Instructions on that Head: And have endeavoured to render that part which has put many to a Ne plus ultra (as being somewhat less intelligible, and not easily retained in Memory) I mean the Addition and Subtraction of the Logarithms of Decimals, plain to any of a moderate Capacity; and have enlarged in a familiar way on the Use of Logarithms in Multiplication, Division, Involution, Evolution or the Extraction of the Roots of all Powers; and in the Solution of all the Cases of Compound Interest: As also how Operations in Vulgar Fractions are performed by Logarithms, whereof I have given you a large Table actually and by Inspection to 10000, and made it subservient for Natural Numbers, tho so great as 100000000, by help of a Table of Proportional Parts (there also inserted) or without it; and have taken the elaborate Pains to write both Tables all over with my own Hand, that I might the better answer for their Accuracy: In doing whereof, I have corrected 33 Errors in one of our last published Tables to 10000; and comparing the same also with Mr. Norwood's 3d Edition of his Trigonometry, I have rectified his in 182 several places: so that I hope mine will be found very Correct. In Lineal Arithmetic I have performed my Operations three several ways, and have shewed how to make the Lines of Chords for the Mensuration of Arks of Circles; the Line of half Tangents for Diameters, or those Great Circles represented thereby in Projections of the Sphere; and the making the Line of Numbers, commonly called Gunter's Line, to any Radius from a Table of Logarithms; and this both on a right Line and on the Ambit of a Circle: which I would not omit, in regard I found many of the Instrument-Makers that I discoursed on this matter, to be ignorant of it. What I have advanced in Instrumental Arithmetic, will be found not only New and Pleasant, but very Useful, particularly the new and plain Way of Working by Neper's Bones; but especially the Use of my New Circular Instrument contrived by me, whereby the Reduction of Coin, Weight, and Measure to Decimals, and the contrary, are speedily, easily, and accurately performed; not by guess, (as some Scales only have them) but actually and explicitly, as I have shewn by various Examples. And Multiplication, Division, and Extraction of Roots, &c. may be done by the two Lines of Numbers made to turn round one within the other, and are placed next the Limb or Edge of the Instrument, the Dimension whereof being so large as 33 Inches, I doubt not but it will be allow'd as the best and most Compleat extant for all Arithmetical Uses. In Algebra I have previously given many more Numerous and Useful Definitions relating to this Analytical Art, than any Treatise of Arithmetic affords; and have throughout that profound Science illustrated the Nature and demonstrated the Truth of the Symbolical Operations

tions by Numeral Examples, intermixing several things New, and my own Invention : particularly the Way of finding the Unciæ of Powers to the 15th, and the Powers of a Binomial to the 10th, as also the Uncia of any Term or Member of any Power without the Knowledge of those of any previous Power. I have also shewed the Reason of the Process in Extracting the Roots from the respective Powers of a Binomial ; and have likewise made the Algorithm of Surds very perspicuous by Examples in Numbers as well as Species, and have done the like in all the Rules of Algebra ; and I have shewed not only the Solution of Simple Equations and those by various Positions, but Quadratical and Cubical, each three different ways : In all which, as well as in Approximation or Converging Series, I have purposely designed to render the Manner of Solution intelligible to a mean Capacity, that being the principal thing in which the Learned Authors on this Subject have been deficient. The Arithmetic of Negatives I have fully accounted for, as will appear if to what is said under [Negative Arithmetic] in the Alphabetical Explanation at the beginning of Algebra, you add what is in Sect. 3. of Chap. 7. in Sect. 2, 3, 4, 5. of Chap. 10. and under the last of my Examples of Converging Series, near the Close of this Treatise.

But notwithstanding the particular Regard of my former Labours, and especially of this, to promote a sort of Learning so Useful to the Public ; yet so numerous are the captious and prejudiced Readers of this our envious Age, that it would be Vanity in me to hope to escape their Censures. But if my Endeavours prove acceptable to the two Classes of Readers for whom they were chiefly intended, i. e. the Candid and Industrious Teacher and the Diligent and Studious Learner ; I shall esteem it a good Step towards an ample Compensation for the uncommon Care and Trouble of this Performance thus dedicated to the Service of the Public ; and shall the less regard the Carps and rash Judications of pragmatistical and ungrateful Dispositions, who fancy there is nothing in Arithmetic beyond what they have acquired the Knowledge of : or if they learn any thing from a Book of this kind, will be the last in paying their Acknowledgment, and probably the first in decrying the Work, because it will instruct some to know more than they would have them, or (as we say) make others as wise as themselves. However, I would not be discouraged by the ill Conduct of such from imitating the most Perfect and Benign Pattern, who is kind to the Unthankful and the Evil : for whatever some Authors may have proposed in being so, I have disclosed my Thoughts this way, much more to promote the Proficiency of the Reader, than to indicate the Science of the Author.

And for the Encouragement of the Impartial and Ingenuous Student, who laying aside Pride and Prejudice, designs only Improvement in the Knowledge of

of what is contained in the subsequent Pages, I can assure him, that I have faithfully adapted this Work to the Capacity of the less Acute, and have offered to his Perusal many things which he will not find elsewhere; of which I have given some Instances, as above, though you have many more mentioned in the Index, which will be found Exuperation.

I have not in this Treatise (as is common where there are many Parts of Mathematicks, &c. in one Volume) only touched on each kind; for you will find Vulgar Arithmetic, Decimals, Logarithms, and Algebra, as copiously insisted on, as in almost any Treatise wrote only upon some one of those Species: Nor can any thing be expected to make the whole more truly agreeable to the Title, which is a piece of Justice that all Authors owe to the Publick, and cannot be denied but to have been fully observed by me, as I am not without Vouchers from good Hands, to confirm the Truth of, especially in my Merchant's Magazine, and my Index to Interest.

And for the Satisfaction of such as are cautious of buying the first Impression of a Book, because, say they, there may be Additions to future Impressions; I do hereby promise, that as I know of no Necessity for it, so I have no thoughts of doing any thing farther on this Subject.

I have, besides what I promised in my Proposal to Subscribers, added an Appendix, which contains the best Way of measuring a greater Variety of Superficies and Solids, than any Book, though wrote purposely on that Subject, exhibits.

In fine, I am so sensible of the Care and Assiduity used to finish this Body of Arithmetic, so as to render it in some degree Compleat, that I hope I need not doubt of its being acceptable to the World; which hath already favoured me, by a kind Reception of my former Endeavours in this Way, although I had not bestowed near that Thought, which (in Gratitude) I have done on this Work, in order to present it, as near as I could, in Perfection.

For besides all that is abovesaid, I have not only comprised in this Treatise, the most material Tables, and other things in my Index to Interest, (which shall never be but here re-printed) but have added Tables of Simple Interest at 4 per Cent. of Discount at 4 and 5 per Cent. and 16 Tables of Compound Interest at 3, 4, 5, and 8 per Cent. And the said Index (before the making these considerable Additions to it) was approved of, and recommended as the most copious, easy, and useful Book that hath been written on that Subject, by the judicious Persons following; besides many others, as I have their own Hands by me to demonstrate.

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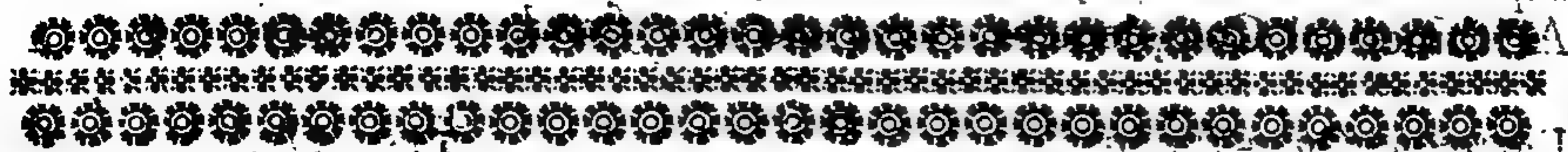
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ERRATA.

On the Title Page of the Table of Logarithms, after not exceeding 10000, add, or 4 Places. Page 176. Line ult. for Numbers, read Number. Page 8. near the Bottom, for Sq. Biquadrat, read Squared Surfsolid. Page 359. After Example 1. read What are the real Roots of this three Dimension (or Cubical) Equation.



THE

INTRODUCTION:

Containing an Alphabetical Definition of all kind of Numbers, and the Terms of Art used in Common Arithmetic explained; which the Reader may have recourse to, as he finds occasion.

(Note, That the like for Algebra is inserted immediately before that Species of Arithmetic.) Vid. Sect. 1. of Chap. X.



Bundant Numbers,] Are such as having their Aliquot Parts added together, the Sum exceeds the Numbers of which they are Parts: as 36 is an abundant Number, because its Aliquot Parts, 1, 2, 3, 4, 6, 9, 12, 18, added, make 55, which is more than the 36.

Abstract Numbers,] Such Numbers in general, as have no Denomination annexed to them.

Absolute Numbers,] Such in reality as they appear to be, as 2, &c. is 2 Units contrary to 2 less than nothing (as in Algebra is explained) and to negative Indices of Logarithms: also it is that known Number in an Equation, which solely possesseth one side. See Algebra.

Aliquot Parts,] Are the even Parts of any Number, when there is no Remainder in the Division. See at the End of Division.

B

Aliquant

Aliquant Parts.] Such as will not divide another Number assign'd without a Surplus or Rest: as 7 is an aliquant Part of 18 or 23, &c.

Amicable Numbers.] Are 2 such, as that the Sum of the Aliquot Parts of one, will make up the other Number alternately.

Arithmetical Complement.] See Sect. 4. of Chap. 7. and Complement under C.

Arithmetical Progression.] See Progression, Chap. 2. Sect. 2.

Articles.] In this Science, are Numbers divisible by 10 without Remainder; as 10, 20, 30, 100, 120, 130, &c. 2000, 4000, &c. the same with round Numbers or Decades.

Artificial Numbers.] Are Logarithms. See Chap. 7.

Antecedent Numbers.] The first named of two that are compared together: As if it be said that some Numbers are in proportion as 3 is to 7; here 3 is the Antecedent, and 7 the Consequent.

Binarys.] Two Places of any Number, (as pointed for the Square Root.)

Biquadrate.] See Powers under P.

Broken Numbers.] Such as are commonly called Fractions, which see.

Central Numbers.] Such as have a Digit placed in the middle between a like Number of Reverse, Circulating, &c. Numbers, as 3457345, 12521, 78678, &c.

Characteristic] Of any Logarithm, is the Index. See Chap. 7.

Circular Numbers.] Are such as being squared, cubed, &c. the Figure in Units place of the Power, is the same with that of the Root; as 6 times 6 is 36, 5 times 5 is 25, &c. which are sometimes called Spherical Numbers.

Circulating Numbers.] According to some, are those Digits which are regularly repeated, whether the Number be of one and the same Digit repeated, as 222, 7777, &c. or of many, as 494949, 372372, &c. And when these fall out in reducing Money, Weight, Measure, &c. to Decimals, you gain many Decimal Places with the less trouble.

Commensurate Numbers.] Such as one Number will justly measure; as 6 and 15 are measured by 3, &c. And the Fraction $\frac{2}{3}$ is of like Value with $\frac{6}{9}$, because the Terms are commensurate by 3.

Compleat Numbers.] See Perfect Numbers.

Complement-Arithmetical.] Is the Remainder when any Logarithm is deducted from 10.

Composed Numbers.] The same as Composit Numbers; which see.

Compound Fractions.] Fractions of Fractions, as $\frac{1}{2}$ of $\frac{2}{7}$, &c. See Chap. 2. Sect. 1.

Composit

Composit Numbers.] Such as are measured by some other besides a Unit; as 297 is composed of 99 by 3, either of which measures 297.

Common Multiples.] See *Multiples* following.

Consequent Numbers.] The second of any two in a proportion. See *Antecedent*.

Concrete Numbers.] The same as *Contract Numbers*.

Contract Numbers.] Such as have a Denomination annexed, as 5 *Lib.* 7 Yards, &c.

Cube Numbers.] The Product of Square Numbers by their Roots; as 8 is the Cube of 2, 27 of 3, being Products of 4 by 2, and of 9 by 3.

Cubed Square and Cubed Cube Numbers.] See *Powers* under P.

Cube-Root.] See *Roots* under R.

Decimal Fractions.] Those whose Denominators are 10, or some Power of 10.

Decades.] The same with *Articles*, as above.

Deficient Numbers.] Those whose Aliquot Parts (added together) are less than the Numbers of which they are Parts; as 26 is a deficient Number, because its Parts 1, 2, and 13, make but 16.

Differences, or Common Differences, as relating to Logarithms.] See the 3d and 4th general Heads under Sect. 4. of Chap. 7.

Digits,] In Arithmetic are Numbers of 1 Place, as 1 to 9 inclusive.

Dividends.] Numbers which are to be divided. See *Division*, Sect. 5. Chap. 1.

Divisors.] Numbers of Parts into which another Number is to be divided. See Chap. 1. Sect. 5.

Dividual.] Separable or Divisible. Also that Part of a Dividend which is immediately under your Operation.

Diminutive Numbers,] Are the same as *Deficient Numbers*, which are explained above.

D.] From *Denarius* (a Penny :) The Mark put over a Column of Pence in Books of Accounts.

Foot. Inch. 12ths

Duodecimals.] Fractions whose Denominators are 12, as 7 : 9 : 7 is 7 foot, 9 inches, (or 9 twelfths of a foot) and 7 twelfths of an inch, &c. Which are often marked by Measurers thus ;
F. 1. II. E. 1. II. III.

7 : 9 : 7 ; and 48 : 11 : 3 : 10 ; and read the first, 7 foot, 9 primes, and 7 seconds; the second is 48 foot, 11 primes, 3 seconds, and 10 thirds. See *Operations* thereby, Chap. 4.

Duplicate, Triplicate, Sesquiplicate, &c. Proportion.] See *Señ. 3. of Chap. 2.*

Equimultiples.] See *Multiples.*

Evenly even Numbers,] Are those which even Numbers will measure by other even ones; as 48 is measured by 8, 6 times.

Evenly odd Numbers,] Are those which even Numbers measure by odd ones; as 40, which 8 doth measure by 5.

Exponents,] Are Numbers (smaller Characters than those they stand next) which are placed near the upper part of a Root toward the right-hand, and shew what Power of that Root is expressed; as 3^2 is the Square of 3 or 9; 3^4 is the Biquadrate of 3 or 81. Also 4^3 is the third Power or Cube of 4, which is 64; the Exponents being 2, 4, and 3, standing higher than the others or Roots. So likewise 15^5 is the Sur-solid or fifth Power of 15; 7^6 is the squared Cube or sixth Power of 7; 20^7 is the second Sur-solid or seventh Power of 20, which is 1280000000. See *Powers* here and in *Algebra*.

Exclusions.] Such Numbers in a Question, as being excluded, renders it less perplexed and the easier resolved; as might be shewn by several Examples,

Factors.] Both the Numbers, which for the most part in Multiplication are called the Multiplicand and Multiplier, (or Multiplier.)

Figurate Numbers.] Such as do represent some Geometrical Figure, either Superficial or Solid. See those Numbers and Linear.

Fractions.] Any Part or Number of Parts of a Unit *ad infinitum*: as $\frac{2}{3}$ is Vulgar; $\frac{1}{10}$, &c. Decimal; and $\frac{1}{12}$, &c. Duodecimal. See *Chap. 2, 3. and Señ. 10. of Chap. 3.*

Geometrical Progression.] See *Progression.*

Harmonical Proportionals.] See *Musical*, and *Chap. 2. Señ. 3. Head 11.*

Homogeneal Numbers,] Or Homogeneous, are those of the same nature; as the Indices of 2 Logarithms, if they are both affirmative, (without a Mark under) are Homogeneous; or they are so, if they are both negative, or have a Mark under thus, 3 and 2, &c.

Homologous.] Numbers or Terms in a proportion are said to be Homologous, when there is a Similitude between the Antecedents and Consequents; for as 3 to 9, so 7 to 21; here 3 is homologous to 7, as 9 to 21.

Hetero-

Heterogeneous Numbers.] Those which are not of the same kind; as when one is negative, the other affirmative, as 3 and 2, contrary to homogeneous. Also mix'd Numbers, composed of a Whole and a Fraction, as $2\frac{1}{3}$: and in Surds, they are such as have different Radical Signs, as $\sqrt{3}$ and $\sqrt{4}$. Vid. *Algebra*, Chap. 10.

Improper Fractions.] Such whose Numerator is equal to or exceeds the Denominator. See *Chap. 2*.

Incommensurate Numbers.] Two such, as no one Number (except a Unit) will measure, contrary to commensurate; as 7 and 23, &c. cannot be measured by any one Number.

Indices.] Numbers which shew the Power of a Root; and in Logarithms they shew the Number of Places which the natural Numbers belonging to any Logarithm consists of, being the same with Characteristicks. See *Exponents*, and also *Chap. 4*.

Ineffable Numbers.] Are Surds, or irrational Numbers; which last see: Or (according to the Import of the Word) Numbers not to be expressed.

Incomposits.] Numbers which no other but a Unit will measure, being contrary to Composit, and are the same with prime Numbers, as 7, 11, 23, 29, 31, and hundreds more.

Intire or whole Numbers.] Any Number of Units or Ones; (but Fractions are one or more Parts of a Unit) so that one is the middle between infinite Units and infinite Parts: and tho' it is by some not allowed to be a Number, yet since it is the Foundation of all Numbers, whether whole or broken, (for 2, 3, 4, &c. are so many ones, and $\frac{2}{7}$, $\frac{3}{7}$, $\frac{4}{7}$, &c. are so many Parts of one) and since 1 is as properly half the Number of things which are but 2 in all, as 2 is half the Number which are four in all; it follows, that since 1 is not a Fraction, (or Part of 1, which would be a Contradiction to affirm) it must be a Whole, i.e. a whole Unit, or the Number 1, as properly as 2 is 2 Units, or the Number 2, 3 the Number 3, 4 the Number 4, &c. For Unity is as properly an Individual (or inseparable from Number) as these or any other. And if we take a Series of Numbers, as 1, 2, 3, 4, 5, here 1 in all respects is a Number according to its Nature, as any of the other are agreeable to the same common Nature of Number, and 1 is one Term or Place in that Rank as well as the others: and if the five Digits be made one Number, as 12345, 1 is here 1 ten thousand, which is far from being no Number. It's true, 1 does not divide nor multiply, because it would be absurd to say that a Man had

had 1 Pound, Yard, Ounce, or the like, divided between himself; or that because I say, 1 Horse, 1 Field, &c. I should exclude the Number 1, because it does not make more or less than that Horse or Field, and so be contrary to the common Nature of all other Numbers. And as it multiplies and divides as much as it ought to do, making every thing once itself, and giving the Whole to one Person where no one is to have a share with him; so in Addition, &c. it does as all other Numbers do, *i. e.* augments or diminishes any other Number so much as itself amounts to: For if I add 1 to 5, it makes 6; that is, so much more than 5, as is the Number 1 added; as 2 added to 5, makes 7, which is itself (or N^o 2.) more than the 5, &c. And whereas some great Men, as *Euclid*, &c. have defined Number to be a Multitude of Units; it is highly probable they meant no more than this, That as Unity is but 1, and there are Millions of Millions, nay, infinite other Numbers; therefore, say they, that Number (in the general way of speaking, or for the most part without comparison) is a Multitude or Aggregate of Units.

Integers,] Are whole Numbers, compared with their Parts; as 1 Penny is an Integer composed of 4 Farthings, its Parts into which it is divided; 1 Shilling is an Integer compared to Pence or Farthings, of which it is composed. But an absolute Integer is a Unit of the highest Denomination of any Specie of Matter or Thing: as 1 Pound *Sterling*, &c. 1 Ton, 1 Circle, &c. and 2, 3, &c. of the like, are so many absolute Integers.

Irrational Numbers, or Surds,] Are such whose Roots cannot be accurately extracted, as being no Figurate Numbers: But then they are to be considered as Surds or otherways, when compared with the Power they are of. Thus 16 is a Surd, or irrational Number, if supposed the 3d Power of some other; but if you suppose it only the 2d Power, it is not Surd, but compleatly the Square of 4: and the like may be observed of others. And when we meet with Surd Numbers, (or those that are Rational, which are to be wrought with Surds) we mark them thus, $\sqrt[2]{7}$, $\sqrt{7}$ is the way of expressing the Square Root of 7; $\sqrt[3]{27}$ is the Expression of the Cube Root of 27, which is equal to 3, &c. But more of this under *Powers*, &c. in the Algebraic Part.

Lib. or L. (from *Libra* a Pound-weight, or 205.) The Mark put over a Column of Pounds.

Lineal (or Linear) Numbers.] Such as represent or are the Dimensions of a Line, Root, or Side of a Geometrical Figure. Thus if a Figure be an exact (or Geometrical) Square, containing 100 Foot, 100 is the Superficial Number, and the Side or Linear Number is 10: If it be a long Square (or Parallelogram) of the Content of 40 Yards, the Linear Numbers (or Sides) are 4 and 10, or 8 and 5.

Lineal Arithmetic,] Is that Science performed by Lines.

Logarithms,] Are Artificial Numbers, of great use in Mathematicks; the Invention of Lord Neper, Baron of Merchiston. See Chap. 7.

Mixt Numbers.] Whole Numbers and Fractions, (Vulgar or Decimal) which are placed together: as $13\frac{7}{8}$, 29.75, &c. Or any Number composed of Digits, or Digits and Cyphers that are not next the right-hand.

Multiples.] Are Numbers produced by the Multiplication of some known or assign'd Number: as 40 is a Multiple of 8 or 5, because either of those will divide 40 without Remainder, and 20 is a Multiple of 4 and 5.

Multiples, or Equimultiples,] Are Numbers multiplied by one and the same Number: as 12 and 28 are Equimultiples of 3 and 7, for $12:28::3:7$.

Multiples, or Common Multiples,] Are when one and the same Number is produced by different aliquot Parts: as 40 is a common Multiple of 2, 4, and 5, because any of these divide it without Remainder, and because these multiplied one in another produce 40.

Multiplicator.] The same as Multiplier. See Chap. 1. Sect. 4.

Musical Proportionals.] The same as Harmonical. See Chap. 2. Sect. 3.

Head 11.

Negative Arithmetic.] See (N) near the beginning of Algebra, in which this kind is chiefly used.

Numerator of a Fraction.] The Number of Parts contained in it. See Chap. 2.

Ob. (from *Obolus* a Halfpenny.) The Mark put for two Farthings in old Writings.

Perfect Numbers.] Those which are equal to the Sum of their aliquot Parts; as 28 is equal to the Sum of its Parts 1, 2, 4, 7, 14, which is 28; and 1, 2, and 3, are 6.

Parts Proportional.] See 3d and 4th General Heads, Sect. 4. of Chap. 7.

Plain Numbers,] Are those which may be produced by multiplying some Number in another, as 6 the Product of 3 by 2, 8 the Product

duct of 4 by 2, &c. (but 7, 11, 13, &c. are no such.) These are the same with superficial Numbers, because the Content of a plain superficial Figure is produced by multiplying two Numbers, which are supposed its Length and Breadth together.

Positive Numbers.] The same with Affirmative. See *Absolute Numbers*, above.

Powers of Numbers.] Are the Root or first Power; the Square or second Power, produced by multiplying the Root in itself, &c. as follows.

	Roots, or 1st Power.	Square, or 2d Power.	Cube, or 3d Power.	Biquadrate, or 4th Power.	Sur-solid, or 5th Power.	Squared Cube, or 6th Power.	The second Sur-solid, or 7th Power.	The Squared Biquadrate, or 8th Power.	Cubed Cube, or 9th Power.	Squared Sur-solid, or 10th Power.
1st Example	2	4	8	16	32	64	128	256	512	1024
2d Example	3	9	27	81	243	729	2187	6561	19683	59049

Each Power being produced by multiplying the next before it towards the left-hand by the Root:

And that these Terms of the Powers are really what they are called; if the 5th Power or Sur-solid (in the 1st Example 32, in the 2d 243) be squared or multiplied in itself, it produces the squared Biquadrate or 10th Power, for 32 by 32 gives 1024; or 243 by itself makes 59049. And the like may be observed of the rest: for a more full Account of which, see the Word *Powers* in the beginning of Algebra, Chap. 7.

Promiscuous Numbers.] Composed of Digits without any limited Order, as 7291, 3924, and thousands of others, as under *Mixt Numbers*. *Proper*

Proper Fractions.] See Chap. 2. Sect. 1.

Proportion.] See *Subduple*, *Subtriple*, *Submultiple*; and Sect. 3. Chap. 2.

It is marked with Points thus, 3. 4 :: 6. 8. if direct.

Prime Numbers.] Such as no other but Unity will justly divide. See *Incomposits*.

Proportional Parts.] See *Parts Proportional*.

Progression.] Numbers in Arithmetical and Geometrical Progression. See Chap. 2. Sect. 2.

Q. (from *Quadrans* a Farthing) the Mark put over a Column of Farthings.

Quotient.] See *Division*, Sect. 5. Chap. 1.

Roots of Numbers.] The first Powers. See *Powers* above, and *Linear N^o*.

Ratio,] Is the Reason or Proportion that one Number bears to another. Or more particularly it is Direct, Simple Ratio, Duplicate Ratio, Triplicate, &c. See Chap. 2. Sect. 3. Or Ratio in Progression is the Rate by which the Terms increase or decrease.

Rectangle.] The same as Product, which is the Sum produced by multiplying 2 together; as 2 times 4 is 8 = the Product or Rectangle.

Reverting Numbers.] Such as are composed of a like Number of successive Digits ascending and descending, as 345543, 7887, &c.

Round Numbers.] The same with Articles and Decades, which see.

Sesquiplicate Proportion.] See Head 12. of Sect. 3. of Chap. 2.

Similar Numbers,] Are either, 1st, Plain, which are such as form like or similar plain Figures; as a Plain of 21 formed by the Rectangle of 7 by 3, is similar to another of 84 formed by the Sides or linear Numbers 14 and 6; for as 6 to 14, so 3 to 7. Or, 2^{dly}, Similar solid Numbers are such as form like or similar Solids (as Parallelopipedons, or 2 or 3 Dyes joined to the end of each other) of different, but proportionable Dimensions.

S. (i. e. *Solidus*) the Mark placed over Shillings in a Column of Money.

Spheric Numbers.] The same with Circular Numbers, which see.

Subduple Proportion.] Numbers are in subduple Ratio, when the Antecedent contains the Consequent (or the contrary) twice; as 5 to 10, or 40 to 20, and the like.

Subtriple.] Numbers are in a subtriple Proportion, when the Consequent is 3 times the Antecedent, or the contrary; as 9 to 27, or 90 to 30, &c.

Submultiple.] Numbers are in a submultiple Ratio, when the Consequent contains the Antecedent, or the contrary, above three times without Remainder.

Square Numbers.] All such as are produced by multiplying any Number by itself, because that Product represents a Figure of four equal Sides.

Surd Numbers.] The same with Irrational, which see.

Sexagesimal Numbers.] Are such Fractions as have 60 for their Denominator, used in measuring Time, and the Motion of the Celestial Spheres, Geography and Navigation: But they put not down the Denominator in these, no more than in Duodecimals, because it never alters, being always 60, as these are 12. Thus

o I II III IIII IIIII

51 : 30 : 45 : 17 : 21 : 59 are read 51 Degrees, 30 Minutes, (or 60th Parts of a Degree) 45 Seconds, (or 60th Parts of a Minute) 17 Thirds, (or 60th Parts of a Second) 21 Fourths, (or 60th Parts of a Third) and 59 Fifths, or 60th Parts of a Fourth, &c.

Of Operations in this kind of Fraction, the Work of Addition is easy: Adding up a Column of Minutes, Seconds, &c. and dividing by 60, putting the Remainder under the Line, and carrying the Quote to the next Column toward the left hand, &c. borrowing 60 always in Substraction. And for multiplying Degrees, Minutes, Seconds, Thirds, &c. these may be done decimally, by reducing the lower Denominations into the Decimal of the highest, and then working as is shewed in Decimals, Chap. 3. And by the same Rule and Division of Decimals, is the best way to divide these. But see Chap. 5.

Successive Numbers.] Such as are composed of Digits which stand in a natural Succession ascending and descending, as 34567, or 9876.

Tabular Numbers.] Such as are found in Tables, as of Logarithms, Interest, &c.

Tarif Numbers.] The same as Tabular Numbers. But the Term is most used in Tables of Customs, and Series of a Divisor by the 9 Digits.

Terms.] The two Parts of a Vulgar Fraction are call'd its Terms; and so are the several distinct Numbers in an Arithmetical and Geometrical Progression.

Ternary Numbers.] Such as have 3 places: Or even 3 places of any Number are so many Ternarys, as used in extracting the Cube Root.

Triplicate Proportion.] See *Proportion*, or *Seet. 3.* of *Chap. 2.* *Head 10.*

Unit, or Unity.] The Number 1. See *Intire Numbers*, above.

Unevenly odd Numbers.] Those odd Numbers produced by the Multiplication of 2 odd Numbers together; as 63, which is 7 times 9; 45, which is 9 times 5, &c.

C H A P. I.

Treateth of the severall Parts of single Arithmetic (called Common Arithmetic in whole Numbers) containing Numeration, Addition, Subtraction, Multiplication, Division, and the Extraction of Roots, which are called Simple or Single Rules of Arithmetic, as being Fundamental Parts or Principles, by one or more of which, all Operations by Numbers are performed.

S E C T. I. *Of Numeration of Intire Numbers.*

Y this first Part we are taught how to read or write down any Number proposed, by assigning a proper and natural Denomination for the Place of each Digit in any Line, (tho composed of never so many of those Digits) and then by observing what Digit is there placed.

By a Digit we understand any single Figure possessing but one place, as 1 to 9 inclusive.

There is also a Cypher, (or 0) which standing alone, or next the left hand of any single Figure or Number of Figures in whole Numbers, is of no value; it only serving to fill up places, in order to augment the value of the single Figure or Figures, which are placed to the left hand thereof; which places might as well be supplied by a Point (.) or Hyphen (-) thus, if that had obtained a Custom, as the (0) hath.

By what is said it appears, that after we know the Character of the 9 Digits, (which almost every Child learneth too soon as it can read) there is nothing remains to make one able to read any Number,

ber, but to consider by what Name the several Places in any Number or Rank of Digits is called: and that will appear, by what follows, very obvious.

The Denomination of each particular Place of any Number not exceeding 9 Places, or that of Hundreds of Millions.

Examples how the Course or Order of the Places augments toward the left hand infinitely.

How each of the 9 Numbers are to be read in one Line or Number.

One Hundred Millions

Ten Millions ———

One Million ———

One Hundred Thousand

Ten Thousand ———

One Thousand ———

An Hundred ———

Ten ———

One ———

Two Hundred Millions

Twenty Millions ———

Two Millions ———

Two Hundr. Thousand

Twenty Thousand ———

Two Thousand ———

Two Hundred ———

Twenty ———

Two ———

Three Hundr. Millions

Thirty Millions ———

Three Millions ———

Three Hundr. Thousand

Thirty Thousand ———

Three Thousand ———

Three Hundred ———

Thirty ———

Three ———

9th place.
8th place.
7th place.
6th place.
5th place.
4th place.
3d place.
2d place.
1st place.

1 0 0 0 0 0 0 0 0

1 0 0 0 0 0 0 0 0

1 0 0 0 0 0 0 0 0

1 0 0 0 0 0 0 0 0

1 0 0 0 0 0 0 0 0

1 0 0 0 0 0 0 0 0

1 0 0 0 0 0 0 0 0

1 0 0 0 0 0 0 0 0

1 0 0 0 0 0 0 0 0

1 0 0 0 0 0 0 0 0

2 0 0 0 0 0 0 0 0

2 0 0 0 0 0 0 0 0

2 0 0 0 0 0 0 0 0

2 0 0 0 0 0 0 0 0

2 0 0 0 0 0 0 0 0

2 0 0 0 0 0 0 0 0

2 0 0 0 0 0 0 0 0

2 0 0 0 0 0 0 0 0

2 0 0 0 0 0 0 0 0

3 0 0 0 0 0 0 0 0

3 0 0 0 0 0 0 0 0

3 0 0 0 0 0 0 0 0

3 0 0 0 0 0 0 0 0

3 0 0 0 0 0 0 0 0

3 0 0 0 0 0 0 0 0

3 0 0 0 0 0 0 0 0

3 0 0 0 0 0 0 0 0

3 0 0 0 0 0 0 0 0

One Hund. and 11 Mill.

One Hund. and 11 Thous.

One Hund. and Eleven.

1 1 1 1 1 1 1 1 1

1 1 1 1 1 1 1 1 1

1 1 1 1 1 1 1 1 1

Milli.

Thous.

Units.

2 Hund. 20 2 Hund. 20 2 Hund. 20 2 Hund. 20

2 Hund. 20 2 Hund. 20 2 Hund. 20 2 Hund. 20

2 Hund. 20 2 Hund. 20 2 Hund. 20 2 Hund. 20

2 2 2 2 2 2 2 2 2

2 2 2 2 2 2 2 2 2

2 2 2 2 2 2 2 2 2

Millions.

Thousand.

Units.

3 Hund. 30 3 Hund. 30 3 Hund. 30 3 Hund. 30

3 Hund. 30 3 Hund. 30 3 Hund. 30 3 Hund. 30

3 Hund. 30 3 Hund. 30 3 Hund. 30 3 Hund. 30

3 3 3 3 3 3 3 3 3

3 3 3 3 3 3 3 3 3

3 3 3 3 3 3 3 3 3

Sect. I. *Numeration of Intire Numbers.* 13

From the Scheme above it may be observed, *viz.* 1st, From the middle Column it is plain that every place towards the left hand in any Number is 10 times the Value or Number of the place next it towards the right hand ; as 1, 2, or 3, in the 2^d, 3^d, or 4th places becomes 10, 100, 1000 ; 20, 200, 2000 ; and 30, 300, 3000, &c.

2^{dly}, The Column next the left hand gives you the Name that any Number in any place (not exceeding the 9th) is to be called by : As the first or uppermost in each of the three Examples above, is the Hundreds of Millions place ; and consequently the Numbers are in Value 1, 2, and 3 hundred Millions, because the Digits there placed are 1, 2, and 3. But instead thereof, if 4, 5, 6, &c. were put in those places, the Numbers must be 4 hundred Millions, 5 hundred Millions, or 6 hundred Millions, &c. the Value or Name depending on the place that any Digit possesseth in any Number.

3^{dly}, From the third Column it is evident, that in reading a Number there is a Contraction or Abbreviation of the Words in the first Column to be used. Thus (in the third Example) we do not read the three first Lines 3 hundred Millions, 30 Millions, and 3 Millions ; but do only name the word Millions after the last of the three Figures. Thus 3 hundred thirty three Millions, and so of the Thousands, we say 3 hundred thirty three Thousand, &c. 333.

By these Rules, any Number, tho never so great, may be read, as is farther exemplified by the following Table of this Art of Numbering ; which is much more copious and ample, than any Arithmetic that I know of exhibits.

The Numeration TABLE.

Places each Number or Line of Figures consisteth of.	Quinquillions.					Quadrillions.					Trillions.					Billions.					Millions.					Number of Lines reckoned upward.											
	Hundred of M. X of Thousand Thousands Hundreds Tens Units	Hundr. of Thous. X of Thousand Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units	Hundr. of Thous. Tens of Thous. Thousands Hundreds Tens Units																		
36	1	2	3	4	5	6	7	8	9	8	7	6	5	4	3	2	3	4	5	6	7	8	9	8	7	6	5	4	3	2	3	4	5	6	7	8	34
	2	9	0	7	6	0	0	0	4	3	0	0	0	0	1	3	2	5	7	3	2	1	0	0	0	0	0	7	3	2	1	2	4	3	7	33	
35	3	1	0	0	0	0	0	4	2	3	2	0	3	0	4	4	3	2	2	0	0	0	0	0	3	2	1	5	7	0	0	0	0	0	32		
34	2	0	0	0	0	7	2	3	4	0	0	3	4	0	0	0	4	0	0	0	0	0	0	5	7	6	4	3	0	0	4	2	1	31			
33	3	4	0	0	0	0	2	3	4	5	0	0	0	0	4	2	5	5	5	0	0	0	0	0	3	2	1	4	2	6	3	30					
32	4	5	6	0	0	0	5	2	1	3	4	5	6	0	0	3	2	1	5	7	0	0	0	4	2	1	6	5	2	29							
31	3	2	1	0	0	0	4	5	0	4	0	6	0	0	1	2	3	5	1	0	0	0	1	3	2	7	2	28									
30	4	2	3	0	0	0	0	4	3	2	1	7	6	4	3	2	1	0	0	2	3	4	0	0	2	9	1	27									
29	2	1	2	3	4	5	6	7	8	9	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	26									
28	3	2	1	2	3	4	5	6	7	8	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	25										
27	4	3	2	1	2	3	4	5	6	7	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	24											
26	5	4	3	2	1	2	3	4	5	6	0	0	0	0	0	0	0	0	1	2	3	4	5	6	23												
25	6	5	4	3	2	1	2	3	4	5	0	0	0	0	0	0	0	0	1	2	3	4	5	22													
24	7	6	5	4	3	2	1	2	3	4	0	0	0	0	0	0	0	0	1	2	3	4	21														
23	8	7	6	5	4	3	2	1	2	3	0	0	0	0	0	0	0	0	1	2	3	20															
22	9	8	7	6	5	4	3	2	1	2	0	0	0	0	0	0	0	0	1	2	19																
21	1	2	3	4	5	6	7	8	9	1	0	0	0	0	0	0	0	0	1	18																	
20	2	3	4	5	6	7	8	9	0	0	2	3	0	0	0	0	0	0	1	17																	
19	3	0	0	0	0	4	5	6	7	8	9	3	4	0	0	0	2	1	16																		
18	4	0	0	0	0	5	6	7	8	9	2	3	4	5	0	4	3	2	15																		
17	5	0	0	0	0	6	7	8	9	1	2	3	4	5	4	3	3	14																			
16	6	0	0	0	0	7	8	9	0	1	2	3	4	3	6	4	13																				
15	7	0	0	0	0	8	9	0	0	1	2	3	4	4	5	12																					
14	8	0	0	0	0	9	0	0	0	1	2	3	4	6	11																						
13	9	0	0	0	0	8	7	6	5	4	3	2	1	10																							
12	1	2	3	4	5	6	7	8	9	0	1	2	9																								
11	2	0	0	3	4	5	6	7	8	9	3	8																									
10	3	0	0	0	4	5	6	7	8	9	7																										
9	4	0	0	0	5	6	7	8	9	6																											
8	6	0	0	0	7	8	9	0	5																												
7	7	0	0	0	8	8	9	4																													
6	8	0	0	0	9	1	3																														
5	9	8	7	6	5	2																															
4	4	3	2	1	1	1																															

1. It may not be improper to inform the Reader, that we make use of the words Billions, Trillions, &c. to prevent the Confusion that would arise by the often repeating Millions of Millions, &c. And if it be enquired how much a Trillion (or the like) is; I look for the Units of Trillions at the top of the Table, and casting my Eye downward in that Line till I come to the lower end of it, I then look directly toward the left hand, and find it a Number consisting of 19 places, *viz.* 18 Cyphers and (1) next the left hand in the 19th place, and is found by involving (or multiplying) a Million in itself, and that Product by a Million. So that a Trillion is as much as to say, one Million of Millions of Millions. So likewise a Quartillion is 1000000 multiplied three times in itself, (called its Biquadrate) and consists of 25 places: A Quinquillion is 1000000 multiplied 4 times in itself, and consists of 31 places, (called the Sur-solid or fifth Power of 1000000, of which Powers I shall speak in a proper place) All which appears plain by the foregoing Table: for Units of Quinquillions, casting your Eye downward to the end of that Column or Series, and thence directly towards your left hand, you find the Figure 31, which shews it consists of 31 places, *viz.* 30 Cyphers and (1) next the left hand. And thus may you find what number of places any Number in the whole Table consists of.

2. Or if you would know the Value of a Number consisting of any number of places, it is but looking for the places in the Column of places, and casting your Eye directly to the right hand, till you come to a Figure, which tracing upward in the same Series or Row, you have the Name or Value of the Number, consisting of any of the places given.

3. By the Table it appears also, that there is no more difficulty in reading a Number of 36, &c. places of Figures, than in a Number consisting of 6 places. For when any large Number is required to be read, begin at Tens place, and tell 6 towards the left hand, over which make 1: then continue to tell 6 more the same way, and over that make a 2: and so forward 6 more, and make 3, (which will fall over the 19th place:) So that having marked thus your whole Number given as in the Table above, I read, for example, the first Number in the Table thus:

103 Thousand, 456 Quinquillions,
 789 Thousand, 876 Quartillions,
 543 Thousand, 234 Trillions,
 567 Thousand, 898 Billions,
 765 Thousand, 432 Millions,
 345 Thousand, 678.

And the second in the Table thus ;—290760 Quinquillions,
 4300 Quartillions,
 1325 Trillions,
 732100 Billions,
 73 Millions,
 212437

In short, the Digit being known, and the place it possesseth, we have nothing to do but first to mention the Digit, and then the Place. As 9 in Units place is 9 Units, 8 is 8 Units, &c. 9 in Tens place is 9 Tens or Ninety ; 9 in Hundreds place is 9 Hundred, &c. So 365 is 3 in Hundreds place, 6 in Tens place, and 5 in Units place ; or 3 Hundred, 60, and 5 : And the like of any other Numbers.

The narrow Column toward the right hand of the rest, may serve to refer to the Table upon occasion. As the Minutes since the Creation to *Anno* 1716 inclusive, are 3006387360, which consisting of ten places, is numbered as the 7th Line in the Table, with respect to the Names of the places : So likewise it being computed (in the Use of Multiplication) that the Number of Diamonds of a quarter of an Inch square that would pave our Globe, supposing it even and all Earth, are 12813844858011648000 ; which consisting of 20 places, is numbered or read as the 17th in the Table. And the Value of those Diamonds being £. 1281384485801164800000, which consists of 22 places, it must be read as the 19th in the Table above.

Thus it appears, that the Table is abundantly large enough to afford an Example how the greatest Number that can arise from almost any Subject, may be numbered : and, in truth, I have made it so large to oblige some curious Persons by way of Speculation, more than for any absolute Necessity there is for it.

There is likewise another Way of expressing Numbers by Letters, used by the *Roman* Numerists, and in Accounts in our antient Records, &c. and may be termed Literal Numbers, or the Numeral Letters ; which are these :

I	1	XXV	25	CC	200
II	2	XXX	30	CCC	300
III	3	XXXV	35	CCCC, }	400
IV	4	XL	40	or CD }	
V	5	XLV	45	CDXC	490
VI	6	L	50	D	500
VII	7	LV	55	DC	600
VIII	8	LX	60	DCC	700
IX	9	LXX	70	DCCC	800
X	10	LXXX	80	CM, or }	900
XI	11	XC	90	DCCCC }	
XII	12	C	100	M, or }	1000
XV	15	CX	110	CID }	
XX	20	CXLV	145	CID	1500

$$CIDCCCXX = 1720.$$

SECT. II. *Of Addition of Intire Numbers.*

ADDITION is a Rule whereby several (even tho never so many) Sums are aggregated and contracted into one Sum, called the Total.

2. If the Numbers to be added be of one Denomination, or be abstract Numbers, it is properly called Single Addition; and in this case let the Name of the thing you add be what it will, you must for every 10 in Units place carry 1 to the Tens place, and for every 10 in that place, carry 1 to the Hundreds; for every 10 in the Hundreds place, 1 to the Thousands place, and so forward, if you have never so many places: because in Numeration it has been shewn, that 10 in Units is 1 in Tens place, &c.

EXAMPLES.

L. Sterling.	lb Weight.	Ells.	Hundr. Weight.	Barrels.
17642				
3769	9367		9763	1764
8458	14239	9762	872	86
4764	4763	2997	939	9
13	8524	3862	26	732
327	8	8764	147	876
97864	0934	329	9183	384
132837	37635	25714	20930	3851Sums

l.	s.	d.
7463	19	7 $\frac{1}{2}$
421	—	10
833	4	6 $\frac{3}{4}$
1008	17	—
94	12	11 $\frac{1}{4}$
9	8	4
363	10	10 $\frac{1}{2}$
1371	—	— $\frac{1}{4}$
432	13	4
92	—	11 $\frac{3}{4}$
140	10	9 $\frac{1}{4}$
832	—	10
721	19	8
9367	3	11
431	10	10 $\frac{3}{4}$
210	11	6
182	11	11
32	16	8 $\frac{1}{4}$
1003	—	7
47	1	11
82	—	10
312	15	9 $\frac{1}{2}$
1714	3	11

3. If the Numbers to be added are Contract, or have several Denominations, which depend on the Value of the same thing, or on the same Sum received and paid, &c. as the Column of Pounds, Shillings, Pence, and Farthings in the Margin; you must begin with the Farthings, and for every 4 of them carry 1 to the Pence, for every 12 Pence carry 1 to the Shillings, for every 20 Shillings carry 1 to the Pounds, &c. But because I would not have you point at every 12 in the Pence place, which fullies and fouls Books that are kept clean; I have therefore inserted the following short Table, that you may see how many Shillings is in any Column of Pence that can well be supposed to come to hand; which may serve till you have learned how to divide by 12: for then you need not the Table.

The TABLE used in Addition of Pence.									
d.	s.	d.	s.	d.	s.	d.	s.	d.	s.
12=1		60=5		108=9		156=13		204=17	
24=2		72=6		120=10		168=14		216=18	
36=3		84=7		132=11		180=15		228=19	
48=4		96=8		144=12		192=16		240=20	

Note,

Note, That $\frac{1}{4}$ is 1 Farthing, or one 4th part of a Penny (or other thing) $\frac{1}{2}$ is one half of a Penny, &c. and $\frac{3}{4}$ is 3 fourth parts of a Penny or other thing that is placed before it.

And in consequence you find the Sum of the Farthings in the last Example to be 19 (or 4 Pence 3 Farthings:) Put down the $\frac{3}{4}$ (as you see in the Sum) and carry the 4 *d.* to the Units place of Pence, saying 4 and 1 is 5, and 9 is 14, and 1 is 15, and so on, you'll find when you come to the top of the Series 78 Pence. Put down the 8 on a piece of (by or) waste Paper, and carry the 7 to the Tens place of Pence, saying 7 and 1 is 8, &c. till you come to 18, (at the top of the Column) which put down to the 8, and it makes 188 Pence; which by the little Table is 15 *s.* and 8 over: Therefore put down the 8 Pence, and carry the 15 *s.* to the Units place of Shillings, saying 15 and 3 is 18, and 5 is 23, &c. to the top of the Column, when the Sum is 77. Put down the 7, and carry 7 to the Tens place, saying 7 and 1 is 8, and 1 is 9, &c. which at the top you find 19. Put down the odd 1, (which makes the 7 17 *s.*) and carry half of 18 or 9 to the Pounds, which sum up as by the Example of 1 Denomination, and you find the Sum total 27168 *l.* 17 *s.* 8 *d.* $\frac{3}{4}$.

4. Hence it may be inferred, that any Numbers may be added, tho of divers Denominations, as tho they were of one Denomination or Name. So the Sum of the several Columns of Money foregoing, is 27159 *l.* 182 *s.* 184 *d.* 19 *qrs.* or *l.* 27168 : 17 : 8 $\frac{3}{4}$. for the 19 Farthings any one knows is 4 *d.* $\frac{3}{4}$, 184 Pence by the little Table is 15 *s.* 4 *d.* and 4 *d.* in the Farthings is 15 *s.* 8 *d.* 182 *s.* is *l.* 9 : 2 : — and the 15 *s.* in the Pence is *l.* 9 : 17 : — Put down the 17, and add the 9 *l.* to 27159, makes the Total *l.* 27168 : 17 : 8 $\frac{3}{4}$.

This is much the best way; done without pricking and carrying from one Denomination to another, which one is apt to forget when he has a mind to run a Sum over a second time.

And by one and the same Method you add all kind of Denominations of Weight, Measure, Money, &c. And for reducing the Sums properly, (as that above is done) you will easily see how to do that by the little Table following of the Quarters of Hundreds, &c. in the Sum of the Pounds, &c.

	<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>qrs.</i>
	27159	: 182	: 184	: 19
	<hr/>			
Add {			4	3
		15	:	4 : —
	9	:	2 : —	
	<hr/>			
	<i>l.</i> 27168	: 17	:	8 : 3

TABLE 1. Of Averdupois Weight.

Ton	Hund.	qr.	C.	Pounds	Ounces	Drams
1	20	80	2240	35840	573440	
	1	4	112	1792	28672	
		1	28	448	7168	
			1	16	256	
				1	16	

TABLE 2. Of English Coin.

Farth.	Pence	Groats	Shillings	d.	Nobles	Angels	Marks	Pounds
4	1							
16	4	1						
48	12	3	1					
320	80	20	5	8	1			
480	120	30	10		1½	1		
640	160	40	13	4	2	1½	1	
960	240	60	20		3	2	1½	1

These Tables are put into the most easy and useful Method that I could think of, and are more especially adapted for reducing *Averdupois Weight* (by the first Table) and *English Coin* (by the second Table) from any one Denomination to another, with one Multiplication or Division.

For the more easy adding this or any other Example of *Averdupois greater Weight*, I have inserted the following little Table; which shews the *Quarters* of Hundreds in a Column of Pounds.

*A Table of Quarters of Hundreds
in a Column of Pounds.*

lb	qr.C.	lb	qr.C.	lb	qr.C.
28	1	140	5	252	9
56	2	168	6	280	10
84	3	196	7	308	11
112	4	224	8	336	12

In the Example last above, having added each single Series or Row of Figures (as by the Rules for one Denomination foregoing) I find the Sum 2054 Ton, 176 Hundred, 24 Quarters, and 230 Pounds.

Then (as in the Example before) I must reduce this Sum properly, which is done thus: By the little Table last inserted, 'tis plain that in 230 lb there are 8 qrs. and 6 lb. In the 24 Quarters are 6 Hundred; and in the 176 Hundred (by taking half except Units place, and adding the odd 10 to the Units) are 8 Ton, 16 C. the Sum of which is Ton 2063: 4: 0: 6, done without pricking, or any Charge to the Memory. But for such as can do Division, the last little Table will not be of such necessary Use, as it is to others.

*A Table shewing the Ounces in
a Column of Drams; or lb
in that of Ounces.*

16=1	80=5	144=9
32=2	96=6	160=10
48=3	112=7	176=11
64=4	128=8	192=12

*An Example of adding
Averdupois greater
Weight.*

Ton	C.	qr.	lb
47:	3:	2:	27
192:	19:	—:	12
43:	18:	3:	24
973:	—:	2:	14
9:	15:	1:	15
47:	18:	3:	—
55:	9:	2:	23
34:	16:	2:	25
84:	19:	3:	17
179:	16:	2:	12
84:	8:	1:	25
73:	18:	3:	24
234:	17:	—:	12

Sum 2054: 176: 24: 230

	8:	6	} Ad.
	6:	0: —	
8:	16: —		
<hr/>			
2063:	4:	0:	6

The next Example is done thus:

Having summed up the Units, and then the Tens place of Drams, I find the Sum 191; the Ounces in like manner 177, and the Pounds 3234.

And by the little Table above (which any one may make or enlarge by adding 16 to itself, &c.) I find that the next Number to and less

less than 191, is 176, against which stands 11 Ounces; and 191 is 15 Drums more, therefore I put 11 *Oun.* 15 *dr.* down as you see. And the Sum of the Ounces being 177, I look for that in the Table, and find the next and less Number thereto to be 176; against which is 11. So that I put down lb 11:1 *Oun.* as you see in the Margin, and as in the foregoing Examples; which 11 added to the Pounds, and the 1 to the 11 Ounces, &c. the Sum reduced by the little Table is lb 3245:12:15.

And thus I have given you fundry Examples and Rules, altogether new, for adding large Numbers of several Denominations, as tho they were but one Denomination, without carrying any thing from one Name or Denomination to another: which new Method I take to be every way preferable to the common, especially where there are large Examples to be added of several Denominations. I shall give you farther Tables, whereby little Tables may be made for Addition; or wherefrom Subtraction and Reduction of any thing may be performed.

*An Example of adding
Averdupois lesser
Weight.*

lb	Oun.	dr.
764 :	15 :	15
73 :	13 :	12
92 :	10 :	13
173 :	— :	7
39 :	14 :	11
91 :	12 :	10
475 :	9 :	8
39 :	15 :	12
99 :	11 :	11
732 :	4 :	14
74 :	14 :	9
86 :	11 :	13
37 :	7 :	10
75 :	13 :	14
32 :	10 :	8
124 :	4 :	3
53 :	11 :	14
176 :	4 :	7

lb. 3234 : 177 : 191

: 11 : 15 } Add.
11 : 1

lb. 3245 : 12 : 15 Sum.

TABLE 3. Wine-Measure.

Ton	Pipes	Hogsh.	Tiertian	Gallon	Quarts	Solid Inches.
1	2	4	6	252	1008	58212
	1	2	3	126	504	29106
		1	1½	63	252	14553
			1	42	168	9702
				1	4	231
					1	57¼

TABLE

TABLE 7. Square Measure.

Square Miles	Square Acres	Square Rods	Square Poles	Square Yards	Square Feet	Square Inches
1	640	2560	102400	3097600	27878400	4014489600
	1	4	160	4840	43560	6272640
		1	40	1210	10890	1568160
			1	$30\frac{1}{4}$	$272\frac{1}{4}$	39204
				1	9	1296
					1	144

TABLE 8. Of Solid Measure.

Solid Inches.	Feet Solid	Solid Yards	Solid Poles	Rods	Acres	Mile
1728	1					
46656	27	1				
7762329	$4492\frac{1}{8}$	$166\frac{375}{1000}$	1			
1963885176	$1136507\frac{525}{1000}$	$42092\frac{875}{1000}$	253	1		
15711081408	9092061	336743	2024	8	1	
254358061056000	147197952000	5451776000	32770584	129528	16191	1

TABLE 9. Of Troy-Weight.

Pounds	Ounces	Pennywt.	Grains
lb	$\frac{1}{16}$	dw.	gr.
1	12	240	5760
	1	20	480
		1	24

TABLE 10. Apothecarys Weight.

Grains	Scruple	Dram	Ounce
gr.	$\frac{1}{3}$	$\frac{1}{8}$	$\frac{1}{16}$
20	1		
60	3	1	
480	24	8	1

TABLE

TABLE 11. Of Time.

Years	Weeks	Days	Hours	Minutes	Seconds
1	52 $\frac{2}{11}$	365 $\frac{1}{4}$	8766	525960	31557600
	1	7	168	10080	604800
		1	24	1440	86400
			1	60	3600
				1	60

TABLE 12. Of Motion.

Seconds	Minutes	Degrees	Sines	Quadrants	Circles
60	1				
3600	60	1			
108000	1800	30	1		
324000	5400	90	3	1	
1296000	21600	360	12	4	1

The Tables foregoing are so easy, as to need little Explanation: I have put them in two Methods, a small matter differing. Table 1. which is of Averdupois Weight, is to be thus read; 1 Ton is 20 Hundred, 80 Quarters of C. 2240 Pounds, 35840 Ounces or 573440 Drams: Also 1 C. is 4 Quarters, 112 lb. 1792 Ounces, &c. reading from the right towards the left hand, all which is useful in Reduction.

And the same is to be observed in the second sort of Table, only here you read the contrary way, from the right hand toward the left: As 1 Pound Sterling is 1 $\frac{1}{2}$ Marks, 2 Angels, 3 Nobles, 20 Shillings, 60 Groats, 240 Pence, 960 Farthings. One Mark is 1 $\frac{1}{3}$ (or 1 Angel and 1 Third) 2 Nobles 13 s. 4 d. 40 Groats, 160 Pence, &c. And the Numbers above shew that 4 Farthings is 1 Penny, 4 Pence 1 Groat, 3 Groats 1 s. 6 s. 8 d. = 1 Noble, &c.

As to the Proof of Addition, it is either performed by Addition or Subtraction.

E

Thus

Thus the Sum of the 3 upper Lines added to the Sum of the 2 lower, is equal to the Sum Total: 9876
 For the Sum of any Parts added to the rest of the 5432
 Parts, must give the Sum Total of all the Parts 1234
 which make the Whole. 567

Or the Sum of the two lowermost deducted from 89
 the Sum Total, leaves the Sum of the
 greater, or of the three uppermost Sum Total 17198
 Numbers.

And thus I hope I have laid down such plain and copious Rules, &c. as will be useful to the young Reader in adding Money, Weight, Measure, &c.

Sum of the 3 uppermost	16542
Sum of the 2 lower Lines=	656
<hr/>	
Sum Total, or Sum of the } Sums	17198 Proof.
The lesser deduct.	656
<hr/>	
Leaves the greater=	16542 Proof.

When large Sums of Money are (in Records, &c.) required to be expressed Literally, or in Numeral Letters, they may be wrote, &c. thus;

L. S. D.			or thus, more easy for Addition thereof.		
			M. C. X.	L. S. D.	
MDCCXXXVI:	VI:	IX ob	I, VII, III, VI:	VI:	IX ob
M ¹⁰ .DCCCCXXIX:	X:	II	X, IX, II, IX:	X:	II
M ² .CCXCIX	: XI:	IX	VIII, II, IX, IX:	XI:	IX
M ²⁰ .DLXXXVII	: X:	IX ob	XX, V, VIII, VII:	X:	IX ob
M ⁵¹⁰ .CLII	: VI:	VIII	DX, I, V, II:	VI:	VIII
M ¹⁹ .DCCXLV	: XIX:	VI ob	XIX, VII, IV, V:	XIX:	VI ob
M ⁶⁰ .CCXXXI	: XI:	IV	LX, II, III, I:	XI:	IV
<hr/>			<hr/>		
M ⁶³¹ .DCLXXXII	: XVII:	— ob	DCXXXI, VI, VIII, II:	XVII:	— ob
<i>viz.</i> 631682 : 17 : — $\frac{1}{2}$			or 631682 : 17 : — $\frac{1}{2}$		
Sums Total			Sums Total		

To add the first Column 'tis easy till you come to the Pounds, and there add together 1st all under 10, to each Ten there add all Tens

Sect. 3. Subtraction of Intire Numbers. 27

Tens under 100; to those add what is under 1000, and the Thousands carry'd to the rest.

Note, The M, C, and X are Thousands, Hundreds, and Tens, the Titles of the Columns they stand over, as to place.

S E C T. III. Subtraction of Intire Numbers.

THIS is a Rule whereby the Excess or Difference between two Numbers is discovered; that is, we find out by this part of Arithmetic how much one of two Numbers given, is greater or less than the other. Thus if 15 be compared with 20, we find it lesser by 5.

Hence it appears, that in Subtraction there are always 2 Numbers given, from whence a third is discovered.

Of the 2 Numbers given, the greater I call the *Compound Number*, (as being composed of the lesser Number and the Difference between those given.) The lesser I call the *Subtrahend*, it being that which is to be taken from or drawn out of the greater. And when that is done, there ariseth the third Number, which may be termed the Remainder, Excess, or Difference between the Numbers given, and is the Number sought for in this Part of the Art of Numbering.

As in Addition, so in Subtraction the Numbers given are either of one simple Denomination, or else they are one or both of several Denominations or Names; for the Numbers given are Abstract or Concrete.

I shall next illustrate what is said, by Examples of one and more Denominations in the common Way of Working; and 2dly, in another.

Examples of one Denomination, or of Abstract Numbers.

Example 1.

Lent l. 71032.
Received l. 9735

Remainder l. 61297

Example 2.

Borrowed l. 19721
Paid l. 8957

Remainder l. 10764

Example 3.

Received l. 9211
Disbursed l. 1973

Rem. = l. 7238

Examples of several Denominations, (or of Contract Numbers.)

Example 4.

Gained l. 1192 : 12 : 3
Lost l. 287 : 14 : 7

Remaineth gained l. 904 : 17 : 8

Example 5.

Debtor l. 10132 : 10 : 4 $\frac{1}{4}$
Creditor l. 975 : 15 : - $\frac{3}{4}$

Remaineth Dr. l. 9156 : 15 : 3 $\frac{1}{4}$

Example 6.

Received as an Agent or Factor, to be applied and }
 disbursed as *per* Order of my Employer ——— } $l. 9000 : — : —$

Paid *A. B.* for Goods bought — $l. 2072 : 13 : 4$

For a Ship with Rigging — $936 : 19 : 2$

For Custom to the King — $97 : 15 : 3\frac{1}{4}$

For Insurance — $72 : 3 : 6$

For Freight — $100 : 11 : 9\frac{3}{4}$

In all — $3280 : 3 : 1$

Which Sum of the Payments being deducted }
 from the $l. 9000$, the Remainder (in the Fac- } $l. 5719 : 16 : 11$
 tor's hands) is ———

Example 7.

	Weight	Value
	C. qr. lb	l. s. d.
Bought of <i>A. B.</i> Sugars	$193 : 3 : 25$	$386 : 19 : 4$
of <i>C. D.</i> more	$323 : 3 : 17$	$532 : 18 : 6\frac{1}{4}$

Bought in all $517 : 3 : 14$ $l. 919 : 17 : 10\frac{1}{4}$

	Weight	Value
	C. q. lb	l. s. d.
Sold <i>E. F.</i>	$25 : 1 : 14$	for $59 : 17 : 6$
to <i>G. H.</i>	$126 : 3 : 25$	at $315 : 12 : 10$
to <i>J. K.</i>	$94 : 2 : 14$	at $235 : 17 : 6\frac{3}{4}$
to <i>L. M.</i>	$87 : 3 : 20$	at $180 : 13 : 4$
Sold in all ———	$334 : 3 : 17$	at $792 : 1 : 2\frac{3}{4}$

Remains unfold C. $182 : 3 : 25$ | $127 : 16 : 7\frac{1}{2}$

Which unfold Goods cost me ——— $364 : 18 : 10\frac{1}{4}$

From which last Sum deducting the next above }
 it, the Remainder is gained (already) by this } $237 : 2 : 2\frac{3}{4}$
 Account ———

Directions for performing the foregoing Operations.

I N the first Example you are to take the lower Line from the upper, or the lesser Number 9735 from 71032. Begin at Units place, and say 5 from 2 cannot be, but 5 from 10, which you must borrow, and add to 2; that is, 5 from 12, and there remains 7. Then having put the 7 under the Line, say 1 borrowed and 3, (the Figure in Tens place of the Subtrahend) is 4, from 3 (in the com- pound

pound Number) can't be; but from 13 (borrowing 10 as before) leaves 9. Which put down, as you see, and say 1 borrowed and 7 (the Figure in Hundreds place of the Subtrahend) is 8 from 10 borrowed (because you can't take 8 from 0) and there rests 2. One borrowed and 9 is 10 from 1 (in the Thousands place of the compound Number) can't be, but 10 from 11 leaves 1, which put under, as you see. And lastly, 1 borrowed from 7 in the upper Line, and the Remainder is 6. So the whole Sum remaining is 61297. And thus any Operation of one Denomination is performed.

Then for several Denominations I shall instance, 1st, in the fifth Example. You must always begin with the least Name, here Farthings; and say 3 Farthings from 1 can't be, but borrowing 1 Penny or 4 Farthings, add to the 1 Farthing makes 5; so 3 from 5, and there rests 2 Farthings: put under as in the Example, and say 1 Penny borrowed from 4 Pence in the upper Line, and there rests 3d. Then say 15 s. from 10 s. can't be; but 15 from 20 s. which you borrow, and the 10, viz. from 30, and there resteth 15. Then say 1 borrowed and 5 is 6, from 12, rests 6 Pounds, &c. as in the former Examples.

The sixth Example is performed by first adding together the Sums laid out, and then deducting that Sum, which is £ 3280 : 3 : 1 from the 9000. Thus 1 d. from 12 you borrow, leave 11 d. 1 you borrowed and 3 s. is 4 from 20 s. which borrow, and the rest is 16; which put under, and deduct the 1 borrowed from 10, &c. as before.

Lastly, In the seventh Example you are to deduct the Hundreds, Quarters, and Pounds sold from those bought: to perform which, you must say 17 Pounds from 14 lb. can't be, but 17 from 28 lb. which you borrow (that being a Quarter of a Hundred, which is the next Denomination) leaves 11; which added to the 14 lb. makes the 25 which you see. Then 1 Quarter of a Hundred borrowed and 3 is 4, from 7 (that is, 4 Quarters or 1 Hundred borrowed and added to the 3 Quarters standing in the upper Line) and the rest is 3 Quarters; which put in the Remainder, saying 1 (that is, 1 Hundred weight) borrowed and 4 (in the Sum of the Sales) is 5, from 7 in the Hundreds bought, leaves 2; which put down, and so proceed, as in subtracting one Denomination: and the quantity of Sugar remaining unfold you find to be £ 182 : 3 : 25. And the Value of what is sold deducted from the whole Value bought, the Remainder is £ 127 : 16 : 7½ (which is the Sum only wanting

wanting to make up the Cost of all that was bought.) Which Sum remaining deducted from the prime Value of what Sugar remains unfold; viz. 182 C. 3 qr. 25 lb. which cost £ 364 : 18 : 10 $\frac{1}{4}$ the remaining Cash is £ 237 : 2 : 2 $\frac{1}{4}$ which is got by this Trading, thus far.

Note, Tho the Subtrahend, as here £ 127 : 16 : 7 $\frac{1}{2}$ stands over the Compound Number £ 364 : 18 : 10 $\frac{1}{4}$, it is as easily deducted as if the lesser Number stood under the greater, as is most usual.

By the Rules and Examples above, I suppose any one may perform Subtraction after the common way.

But the Work may be effected without saying *such a Figure from such a one can't be*, and *1 borrowed*, &c. as in the Margin.

For where any Digit in the compound Number is less than that standing under it in the Subtrahend, mark

the next toward the left hand with a Point, and put over it a Digit, which is 1 less, as here over 4 in the Number given put 3 ; over 3, 2, &c.

Then where the Figures put over the pricked ones (or those given) are still less than those respectively in the Subtrahend, place 10 partly over, but a little toward the left hand ; then you have the very Numbers at large, from whence Subtraction is to be made. Thus 7 from 12 rests 5, 5 from 13 rests 8, 6 from 12 rests 6 ; 5 from 11 leaves 6 ; 9 from 16 leaves 7, and 8 from 14 leaves 6.

Now I have only inserted the Figures over those pointed, and the Tens to explain the Rule ; but 'tis certain, the Work may be as easily performed mentally, by supposing every Figure as aforesaid less by the 1 (supposed 10) which is borrowed from the next towards the left hand of the Number given to make Subtraction from. For whenever you borrow 10, that 10 is presumed to be taken from the next Figure towards the left hand ; and of consequence therefore that is 1 less, (1 in any Series being 10 in another next it toward the right hand.) Thus in the Example, 7 from 12 rests 5 ; where the one Ten borrowed makes the Figure in Tens place a Unit less, *i. e.* the 4 is but 3. And when you say 5 from 13 rests 8, this 1 borrowed is actually taken from the next Digit 3, and leaves it but a 2, and so 2 becomes but a 1, 7 a 6, and 5 a 4, which is all supposed as you perform the Work, without putting down any thing but the Remainder.

So also in divers Denominations, the Unit borrowed being supposed one of the next superior Denomination, must leave that a Unit less, as is explained in

the Margin. Where $2\text{ s. } 6\text{ d.}$ in the upper of the two Lines given, being less than $17\text{ s. } 9\text{ d.}$ in the lower Line; therefore 4 Farthings

taken from the 6 d. makes the $\frac{1}{4}$, and 5 d. resteth; 12 d. borrowed from the 2 s. and put over the 5 d. makes 17 d. and 1 s. resteth; 20 s. taken from the 3 l. makes the said 1 s. to be 21 s. and 2 l. resteth, &c. as in one Denomination; then I have it plain to my sight, that $\frac{1}{4}$ from $\frac{1}{2}$ leaves $\frac{1}{4}$ or $\frac{1}{2}$; 9 d. from 12 and 5 or 17 d. leaves 8 ; 17 s. from 21 leaves 4 s. 7 l. from 12 l. leaves 5 ; 9 l. from 10 leaves 1 l. and 3 l. from 6 l. leaves 3 , without borrowing and paying. Which Method with Use will make the Work easier and shorter than the common way: I mean, when only the two Sums given are wrote down, and the rest performed in the Mind, as in Example.

This is done without the least mentioning borrowing or paying, and with more Ease and Expedition; and may serve also to shew the Nature and Reason of the common Way of Working.

	<i>l.</i>	<i>s.</i>	<i>d.</i>
The Rent-Roll of my Estate } (suppose) is per annum—	1765	12	3
Repairs, Taxes, &c. deduct.	279	15	9
My clear Estate per ann. =	1485	16	6

The Proof of Subtraction is either by Addition or Subtraction: For in the last foregoing Example, the Remainder $l. 1485 : 16 : 6$ being added to the Subtrahend, $l. 279 : 15 : 9$, the Sum is the compound Number given, or $l. 1765 : 12 : 3$; which proves the Operation to be right.

Or by Subtraction. If from the $l. 1765 : 12 : 3$ you take the Remainder $l. 1485 : 16 : 6$, there will then remain $l. 279 : 15 : 9 =$ the Subtrahend given.

S E C T. IV. *Multiplication of Intire Numbers.*

MULTIPLICATION is a Rule which shews the Number of Units produced by making one assigned Number any Multiplicity of times itself.

Or 'tis that Part of Arithmetic of such admirable Extent, that no Number or Quantity can be so great, but another greater may be discovered : For by it not only the Number of single Sands that would compose an Heap as big as our Earth, but even one to extend to the starry Firmament are within the limits of this part of the Numeric Art to compute.

It is an Abridgment of the Work of Addition, performing that in a Minute, that Addition would require some Hours to do.

Thus if 8766 were to be multiplied by 20000, (or to know how many Hours are in 20000 Years) 'tis only to double 8766, which is 17532, and to that place the four Cyphers toward the right hand will make it 175320000 the Answer, (which is done in less than half a Minute.) But how long it would require to put down 8766, 20000 times ; or 20000, 8766 times ; and then add all those Numbers together ; I leave the Reader to judge, and consequently of the Excellency of this Rule, which is justly called Multiplication.

As in the last Section, so in this Part there are two Numbers given to find a third : To instance, as above, 8766 and 20000 are given, and 175320000 is the Number produced by or resulting from the Multiplication.

Of these 3 Numbers 1 (commonly the greater of the 2 given) is called the Multiplicand, the other of those given is the Multiplier, and both together they are called Factors ; and the Number arising therefrom after Multiplication, is called the Product, or (in Geometrical Operations) the Rectangle.

The Relation these three Numbers have to each other, is, That the Product containeth either of the Factors so often as the other Factor contains a Unit : and consequently

As 175320000. to 8766 :: so 20000. to 1. Or

As 175320000. to 20000 :: 8766. 1. &c. But this by the by, till we arrive at the Rules of Proportion.

The whole Business of Multiplication consists in these three things :

1. In knowing mentally and readily what any two Digits multiplied together produce.

†

2. In

2. In the right placing those Products. And,

3. In collecting those particular Products into one general Product.

Hence it follows, that a Table of the Products of one Digit by another be composed, which, before you can proceed farther in this most pleasant and useful Science, must be learned by heart : thus

The first Column is what is absolutely necessary to get by heart.

The second Column for the most part, that is, in multiplying by 10 and 11, does not charge the Memory : for to multiply any Number by 10, is only to place a Cypher to the right hand of the Multiplicand, (for 1, tho a Number, as augmenting and diminishing another by Addition and Subtraction, yet it neither multiplies nor divides.)

And to multiply any Digit by 11, is only to repeat the Digit as in the Example. And I have added the Multiplication of the Digits by 12, because that being got by heart, saves the trouble of making a whole Line, and of adding two Lines together : for when you have that by heart, you can multiply or divide by 12 (a Number much used, as being the Pence in a Shilling, the Inches in a Foot, &c.) as by one single Digit.

<i>The Multiplication Table.</i>				
3 times	3 is = 9	10 times	2 =	20
	4 = 12		3 =	30
	5 = 15		4 =	40
	6 = 18		5 =	50
	7 = 21		6 =	60
	8 = 24		7 =	70
	9 = 27		8 =	80
4 times	4 = 16		9 =	90
	5 = 20	11 times	2 =	22
	6 = 24		3 =	33
	7 = 28		4 =	44
	8 = 32		5 =	55
	9 = 36		6 =	66
5 times	5 = 25		7 =	77
	6 = 30		8 =	88
	7 = 35		9 =	99
	8 = 40	12 times	2 =	24
	9 = 45		3 =	36
6 times	6 = 36		4 =	48
	7 = 42		5 =	60
	8 = 48		6 =	72
	9 = 54		7 =	84
7 times	7 = 49		8 =	96
	8 = 56		9 =	108
	9 = 63		10 =	120
8 times	8 = 64		11 =	132
	9 = 72		12 =	144
9 times	9 = 81			

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The wonderful Productions arising from the placing Numbers, are many and surprizing: I shall here insert an Instance, where, by placing only 9 Figures to the best advantage about 5 Digits given, constitutes all the Parts of the common Table that are absolutely necessary to be inserted for the more apprehensive part of Readers.

A most Brief Multiplication-Table, viz.

<div>Two of these given to be multiplied, or one to be squared.</div>					
Two of these multiply, standing against the Numbers given.	1	9	40	Two of these add, respecting the given Numbers in the middle.	
	2	8	30		
	3	7	20		
	4	6	10		
	5	5	0		

The large Table is so plain, that it needs no Explanation, as shewing that 8 times 8 is 64, 8 times 9 is 72, and the like of the rest.

And this Table is very near as easy; for you must always look for the Digits to be multiplied, in the middle Column: As suppose I would know what 8 times 6 makes; against 8 in the middle Column is 30 towards the right hand, and against 6 in the middle is 10 in the right-hand Column, the Sum of which is 40; and those standing against the others, in the left-hand Column, are 2 and 4, which multiplied together, make 8: so that 8 times 6 is 48.

And to square any of the middle Numbers, as suppose 7, double 20, which stands against it on one side, and multiply that by itself, which stands against 7 on the left-hand side; so 20 doubled is 40, and 3 squared makes 9: so that 7 times 7 is 49, &c.

So much for the Tables: I shall now proceed to shew how the Operation of Multiplication is performed. And,

2. The Application of the Rules in solving Questions, which may serve, instead of Reduction descending, to shew the Use of Multiplication.

Sect. 4. *Multiplication of Intire Numbers.* 35

Proposition 1. To multiply a Number by another, which consists but of one place.

Example 1.
 Multiplicand 79533
 Multiplier 8

Product 636264

Example 2.
 Multiply — 175945
 by 9

Answer = 1583505

Prop. 2. To multiply any Number by another consisting of two, three, or more places. A shorter way for Example 1. See *Multiplication of Decimals.*

Example 1.
 Multiply 74963
 by ... 75

374815
 524741

Product = 5622225

Product = 17002125

Example 2.
 47625
 357

333375
 238125
 142875

Example 3.
 76472
 2475

382360
 535304
 305888
 152944

Product = 189268200

Prop. 3. To multiply when one or more Cyphers are in the Multiplier, but not at the end.

Example 1.
 Multiply 57234
 by 5203

171702
 114468
 286170

297788502

Example 2.
 97532
 32004

390128
 195064
 292596

3121414128

Prop. 4. How to do when one or more Cyphers are next the right hand of one or both of the Factors.

Example 1.
 9769 } Factors.
 1000 }

9769000 = Product =

Example 2.
 7399 } Factors.
 400 }

2959600 = Product.

Example 3.
 34000 } Factors.
 2300 }

102
 68

Product = 78200000

Rules for performing the Operations above.

In Example 1.] Say 8 times 3 (the Units place of the Multiplcand) is 24; put the 4 under the Line, and carry the 2 Tens to the next Product, saying 8 times 3 is 24, and 2 carried is 26; put 6 in Tens place of the Product, and carry 2 as before, saying 8 times 5 is 40, and 2 carried is 42; put the 2 under the Line as you see, and carry 4 (Tens) saying 8 times 9 is 72, and 4 carried is 76; put the 6 under, and carry the 7, saying 8 times 7 is 56, and 7 carried is 63, which (being the Produce of the last Figure) put all down, and you see that 8 times 79333 is 636264. And so much for Directions to multiply and carry the Tens from one particular Product to another; the Reason of which, and of placing the several Products a degree towards the left hand, I shall shew by and by.

In Example 2. of Prop. 2.] You find by the Rules above, that 7 times 47625 is 333375; and then you multiply 47625 by 5 (the next Figure in the Multiplier) saying 5 times 5 is 25: place that 5 under Tens place of the former Product, and proceed as before; and when you come to the 3, put 5 of the Product 3 times 5, under the Tens place of the last Line or Product; and so continue, if you had never so many Figures in the Multiplier, as you see in the other Examples.

In Proposition 3.] You have Examples, that when one or more Cyphers are in the middle of the Multiplier, you must (in beginning to multiply by the Digit next the Cyphers towards the left hand thereof) place the first Figure of the Product not under Tens place of the former Product, as before; but put it so many places extraordinary towards the left hand as there are Cyphers: the Examples thorowly explain the Meaning.

In Prop. 4.] It is shewn, that whenever Cyphers are to the right hand of either or both Factors, you need only to multiply by the significant Figures or Digits, and then place all the Cyphers in one or both the Factors towards the right hand of that Product; and when 10, 100, 1000, &c. is the Multiplier, you need only to put the Cyphers towards the right hand of the Multiplicand, and that is your Product, as by the first Example of this Proposition.

The Reason of the Method in the Process of the Work of Multiplication, by several Digits in the Multiplier.

I shall give an Instance in the Work of the second Example of the second Proposition foregoing; and shall explain this by three Examples depending on each other, the second of which, supposing the Cyphers left out, is an Abbreviation of the first; and the third Example shews how much the Number of Figures in the second Example is lessened by carrying the Tens from the Product of every two Digits to that of the next, &c. and not putting the whole down, which reduceth 15 Numbers into 3.

<i>Example 1.</i>	<i>Example 2.</i>	<i>Example 3.</i>	
47625	47625	47625	
357	357	357	
<hr/>	<hr/>	<hr/>	
35	35		
140	14 | 0		
4200	42 | 00		
49000	49 | 000		
280000	28 | 0000		
	<hr/>		333375 = Sum
250	25 | 0		
1000	10 | 00		
30000	30 | 000		
350000	35 | 0000		
2000000	20 | 00000		
	<hr/>		238125 = Sum
1500	15 | 00		
6000	6 | 000		
180000	18 | 0000		
2100000	21 | 00000		
12000000	12 | 000000		
	<hr/>		142875 = Sum
<hr/>	<hr/>	<hr/>	
Sum = 17002125	17002125	17002125	Sum Total or Product.

In the first of these Examples you have the whole Work of the Multiplication as the Figures stand, the whole being put down without Carrying or Abridgment; as 7 times 5 is 35, 7 times 20 is 140,

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140, 7 times 600 is 4200, &c. Then 50 times 5, 20, 600, 7000, and 40000 make the next 5 Lines: And 300 (the third Figure in the Multiplier) times 5, 20, 600, 7000, and 40000 make the last 5 Lines or Numbers in the Operation.

In the second Example you see how the Work stands when the unnecessary Cyphers are cut off, and thrown out of the Account. And

In the third Example you see that the Sum of the Numbers separated from the Cyphers do respectively make the Numbers, and fall in the same Order as in the second Example of Prop. 2. So that here you see not only the Reasons why the Tens are carried from one single Product to another, when a Line or Number is only made instead of 5: but you also see plainly the Reason why the Units place of every Line stands under Tens place of the Product or Line of Figures preceding.

Thus much for the Theory of Multiplication, I shall next shew,

II. *The Use and Application of Multiplication.*

1. *Of Money.*] Pounds are reduced immediately into Shillings, Pence, or Farthings, by multiplying the given Pounds by 20, 240, or 960, as per Table 2. in Addition.

Example, in 7873 l. how many Shillings? &c.

	<i>Examp. 2.</i>	<i>Examp. 3.</i>
7873 Pounds } Multi- 20 Shill. in l. i. } ply.	L-7873 240 d. in l. i.	7873 l. 960 qr. in l. i.
<hr/> Sh. 157460 = the Answer.	<hr/> 31492 15746 <hr/>	<hr/> 47238 70857 <hr/>

Pence for Answer 1889520 Farth. 7558080 Answ.

Note, These Shillings may be reduced into the Pence by multiplying them by 12; and these Pence into the Farthings by multiplying by 4. And the like of any other Pounds, Shillings and Pence.

Quest. 2. In l. 7873 : 18 : 11 $\frac{3}{4}$
how many Farthings?

Multiply 7873 by 960, as in the third Example; to the Product whereof add 911 = the Farthings in 18s. 11 d. $\frac{3}{4}$ and the Sum is the Answer, as per Margin.

l. 7873 : 18 : 11 $\frac{3}{4}$ 960 <hr/> 47238 70857 <hr/> 7558080 Add 911 qr. in 18s. 11 d. $\frac{3}{4}$ Sum = 7558991 = Answer.

2. *Of*

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2. *Of Averdupois Weight.*] By the first Table in Addition it appears that Tons are reduced into Hundreds by multiplying them by 20; into Quarters of Hundreds by 80; into Pounds by 2240; into Ounces by 35840, &c.

Example, In 85 Ton how many Ounces ?

$$\begin{array}{r} \text{Ounces in 1 Ton} = 35840 \\ \text{Tons given} \quad 85 \end{array}$$

3. *Of Liquid Measure.*] In 157 Ton of Wine, how many Quarts? By the third Table in Addition, you see that in 1 Ton are 1008 Quarts: therefore the Tons being multiplied by 1008, gives the Product 158256 Quarts.

157 Ton. | Answ. Oun. 3046400
1008 = Quarts in 1 Ton.

1256
157

158256 Quarts, Answer.

4. *To reduce Time.*] How many Minutes may we say 'tis since the Creation, supposing the Years, according to Sacred Chronology to be 5716?

By the eleventh Table in Ad- } 525960 Minutes } Multiply.
dition, there are in 1 Year——— } 5716 Years }

315576

52596

368172

262980

5. *To reduce Square or Superficial Measure.*] How many Diamonds, of 16 in a square Inch, will pave the Globe we live on; supposing it a compleat Sphere or Globe all of Earth?

3006387360 Minutes for Answer.

The Ambit (or Circumference) of the Earth, according to Mr. *Norwood's* measured Degree of near 70 *English* Miles in a Degree, is Miles ————— } 25 040

A fourth of which is Miles ————— 6260

Which multiplied by the Earth's Diameter = 7967

4382

3756

5634

The Product is the superficial Content of a Circle, } $\frac{4382}{49873420}$
 whose Circumference is that of the Earth, viz. $\frac{\text{---}}{\text{---}}$ }
 Product

Product brought over _____ **49⁸⁷³⁴²⁰**

Which multiplied by 4, produceth the convex Area
of the Earth (or whole Superficial Content) in Square
Miles } 199493680

Which multiplied by the square Yards in one square }
 Mile, which are (as *per* Table the 7th) ————— } 3097600

119696208

139645576

1795443 12

59848104

The Product is the square Yards on the Earth = 61795 1623 168000

Which multiplied by the Inches in a square } 1296
Yard, which are _____ } _____

3707709739008

5561564608512

1235903246336

617951633168

Produceth the square Inches on the }
Earth's Surface } = 800865303625728000

Which multiplied by the Diamonds in 1 square Inch, viz. 16

4805 191821754368

800865303625728

Produceth the Number of Diamonds }
 which answers the Question } 12813844858011648000

100

And the Value of the Diamonds (as
aforesaid) that would pave the Globe
at 100*l.* each Diamond, is Pounds
Sterling

This Value is numbered as the 16th in the Numeration-Table.

By all which Examples it appears, that in this kind of Reduction, which some call Reduction descending, one general Rule is to be observed, *viz.*

Multiply any Number of any Denomination by any Number of Units of a smaller or inferior Name, that make a Unit of that given, and the Product shews how many of the latter are contained in all the former. For

For

For Proof of Multiplication, see at the end of *Division*.

Note, That many new and very brief Rules and Examples for Multiplication may be seen in *Decimals*.

SECT. V. *Division of Intire Numbers four several Ways.*

DIVISION is that Part of Arithmetic by which a Number given is divided, separated, or distributed into any Number of Parts assigned.

Hence 'tis plain, that it is the Reverse of Multiplication ; for as that produceth an Increase, so this produceth a proportionable Decrease : and consequently the Truth of any Product of Multiplication, is proved by dividing it by one of the Factors, of which more hereafter.

Division performeth the Work of many Subtractions (as Multiplication does that of many Additions) by a few Figures, and in a small Time ; which Subtraction would require an incredible deal of Time, Figures and Paper, to effect. To instance in the former Numbers : If it were proposed to find out how many Years are in 175320000 Hours, there being 8766 Hours in 1 Year, therefore to do this by Subtraction, would require that you deduct 8766 so often from 175320000, till nothing remain, which would be after 20000 Deductions. But the Work of Division shews the Answer with that brevity which you see in the Margin.

$$\begin{array}{r} 8766 \overline{) 175320000} \\ \underline{175320000} \\ 0 \end{array}$$

It appears from hence, That in Division there are always 2 Numbers given, and a third sought for. The Numbers given, are, 1st, That which is required to be divided, which we call the *Dividend*. 2dly, The Number of Shares, Parts or Portions, into which the said Dividend is assigned to be parted or divided, which we call the *Divisor*. 3dly, The Part or Share arising from the Work of Division (being the Number sought for) we call the *Quotient*, (from *quotiens*, i. e. how many times) which shews how often the Divisor is contained in the Dividend.

And if the Dividend contain somewhat more than the Quotient expresseth, (but not so much more as the Divisor amounts to) that Surplusage is called the Remainer or Remainder.

So that the Relation which the two Numbers given and that sought (supposing no Remainer) have to each other, is, That the Dividend contains either the Divisor or Quotient so often as the

other doth a Unit : For as a Unit to the Divisor :: so the Quotient to the Dividend.

Or as a Unit to the Quotient :: so the Divisor to the Dividend ; and consequently

The Product of the Divisor and Quotient is equal to the Dividend by 1 ; any of which Considerations proves the Truth of the Work of Division.

The Operation of Division consists in these five things.

1. In considering how many places toward the left hand of the Dividend the Divisor can be taken from : If from the like Number of Places that are in the Divisor, then,

2. To consider how often the first Figure in the Divisor can be had in the first of the Dividend towards the left hand. But if the Divisor cannot be taken from the like Number of Places with itself from the Dividend ; then to ask how often the first Figure in the Divisor (as before) can be had in the two first places towards the left hand of the Dividend : In either

of which Cases,

3. We put the Answer in the Quotient, (as you see in the Example.)

4. By that Figure so put in the Quotient, we multiply the Divisor, and put the Product under that part marked out in the Dividend.

5. We deduct that Product from the said marked Part or Dividual, and put the Remainder under a Line, as in the Examples.

Proposition 1. To divide by any single Figure or Digit.

Example 1.

<i>Divisor</i>	7	)	<i>Dividend</i>	87654321	(	<i>Quotient</i>
				7		12522045
				7		
				—		
				17		
				14		
				—		
				36		
				35		
				—		
				15		
				14		
				—		
				14		
				14		
				—		
				032		
				28		
				—		
				41		
				35		
				—		

6 Remainder
Exam-

Sect. 5. Division of Intire Numbers.

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Example 1.

8) 1743219 (217902

16

14

8

63

56

72

72

019

16

3 remains.

Example 3.

9) 90123456 (10013717

9

0012

9

33

27

64

63

15

9

66

63

3 remains.

Prop. 2. To divide by 2, 3, or more Figures in the Divisor.

Example 1.

21) 7334565 (349265

63

103

84

194

189

55

42

136

126

105

105

0

Example 2.

136) 1234567 (9077

1224

1056

952

1047

952

95 rests.

Example 3.

9876) 1234567 (125

9876

24696

19752

49447

49380

67 rests.

Prop. 3. To divide by a Divisor having Cyphers in the first, second, &c. places thereof.

Example 1.

350) 987654 (2821

1— 70 —

—

287

280

—

76

70

—

65

35

—

Rests 304

Example 2.

12000) 987654 (820

1— 96 —

—

27

24

—

Rests 3654 to divide by 12000.

Example 3.

1000) 976432 = Answ.

1— —

Quote = 976

Remains 432

Rules for performing the Work of the three last Propositions.

Those by 1. Figure under *Prop. 1.* are so easy, that any one may divide, observing the five general Rules for proceeding. To instance in *Example 2.* I ask how often 8, the Divisor, can be had in 17, the two first Figures to the left hand of the Dividend, (because I cannot have 8 in one place of the Dividend) the Answer is 2 times; which 2 I put in the Quotient, and say 2 times 8 (the Divisor) is 16; which placing under the 17, and taking the 16 from 17, the Remainder is 1. To which bring down the next Figure 4 in the Dividend, (and as you bring down any Figure to a Remainder, mark it with a Point under, lest you bring it down twice) and then say how often 8, the Divisor, can be had in 14, the Answer is 1; which put in the Quotient, and say 1 time 8 is 8, which put under and deduct from 14, and the Remainder is 6; to which bring down 3, (the next Figure in the Dividend) and ask how often 8 in 63, the Answer is 7, which put in the Quotient; and so go on to the end of the Work, observing this Rule, That if after you have brought any Figure down to a Remainder: you cannot have the Divisor in it; you must put a (0) in the Quotient, and bring down the next Figure, as in the last Figure but one of the Example we are upon.

In the Examples to Prop. 2. It is almost as easy to divide by 2, 3, or 4 Figures as 1, observing chiefly this Rule; as in Example 2. of this Prop. I ask how often 1 (the first Figure in the Divisor) may be had in 12, (the two first Figures in the Dividend) the Answer would be 12 times; but you must never take it above 9, that is, you must never put above 9 in the Quotient at one time. And also observe, that you do not put that 9 in the Quotient till you have tryed on a piece of waste Paper whether 9 times 136 do not exceed 1234, (the first part of your Dividend) which, finding it less, may consequently be taken from it; So 9 times 136 is 1224, from 1234, and there rests 10; to which bring down the next Figure (5) in the Dividend, and consider how often 136 (the Divisor) can be had in 105, the Answer is (0) which put in the Quotient, and then bring down the next Figure 6 makes 1056. Then say how often 1 (the first of the Divisor) can you have in 10, (the two first of that part of the Dividend, because that has one place more in it than is in the Divisor :) If you should say, 1 may be had 9 times or 8 times in 10, you will find that the Divisor multiplied by either of those Figures will exceed 1056, and so cannot be taken from that Number. Wherefore finding that 7 times 136 will be less than 1056, I put 7 in the Quotient, and multiplying 136 by 7, it produceth 952; which take from 1056, and the Remainder is 104: To which bring down the 7 (the last in the Dividend) makes 1047, and say how often 1 (the first of the Divisor) can be had in 10 (the two first of the said 1047) the Answer is 7 times, (for it will bear no more, without making the Product of the Divisor thereby to exceed the 1047) so 7 times 136, which is 952, deducted from 1047, the Remainder is 95: So that I find I can have 136 in 1234567, 9077 times, and 95 rests. By observing these Rules you'll easily see how to perform the Work of this Example, and by this any other; and I have been particular in giving Rules for that end.

In the Examples under Prop. 3. When Cyphers are in the first, second, &c. places of the Divisor, cut off the Cyphers, and as many Figures towards the right hand of the Dividend, and divide those remaining towards the left hand of the Dividend by those that remain towards the same hand in the Divisor: and when the Work is ended, put the Figures cut off the Dividend to the right hand of the Remainder.

And for the third Example, to divide any Number by 10, 100, 1000, 10000, &c. You have nothing to do but only cut from the right hand of the Dividend so many places as there are Cyphers at the end of the Divisor: so those remaining towards the left hand of the Dividend

vidend are the Quotient, and those cut off towards the right hand are the Remainder.

But there is

A Second Way of Division:

Where by omitting to put down the several Products, and deducting gradually as you multiply each Digit, you do it with near half the Figures.

Thus the third Example under Prop. 2. is done as in the Margin. For I say how often 9 in 12, the Answer is 1; then instead of saying once 9876 is so much, and putting it under 12345, I say 1 time 6 from 15, (where 10 is added to the 5 in Units place of 12345) and there rests 9, which put under, and saying 1 time 7 and 1 borrowed is 8 from 14 rests 6; 1 time 8 (in the Divisor) is 8, and 1 borrowed is 9, from 13 (borrowing 10 as before) and there rests 4, which put under, and say 1 time 9 (in the Divisor) is 9, and 1 borrowed is 10 from 14, and there rests 2. Then to the Remainder 2469 bring the next Figure in the Dividend, viz. 6, and say how often 9 in 24, the Answer is 2; then proceed as before, 2 times 6 is 12 from 16 rests 4, 2 times 7 is 14, and 1 is 15, from 19, rests 4; 2 times 8 is 16, and 1 borrowed is 17, from 26, and there rests 9, (you borrowing 2 to add to the 6 is 26) 2 times 9 is 18, and 2 borrowed is 20, from 24, leaves 4, or 4944; to which bring down the 7 in the Dividend, and proceed as before.

$$\begin{array}{r}
 9876 \overline{) 1234567} \quad (125 \\
 \underline{24696} \\
 49447 \\
 \underline{67} \text{ rests.}
 \end{array}$$

I desire this Method last mention'd may be well understood, for that the subsequent Examples will be performed by it, as being the shortest and easiest Way, tho some prefer this.

A Third Way of Division.

Divide 1234567 by 136.

In this kind of dividing, the Divisor is put under so much of the Dividend as it can be taken from; for 136 can't be taken from 123, therefore I put it under 1234, the first part of the Dividend, and then ask (as in the second Example of Prop. 2.) how often 1 in the Divisor can be had in 12 in the

Dividend, the Answer is 9 times; which 9 put in the Quotient as usual,

$$\begin{array}{r}
 x09 \\
 x0045 \\
 x234567 \quad (9077 \\
 \underline{x368 \ 6} \\
 x3 \ 3 \\
 x
 \end{array}$$

usual, and say 9 times 6 in the Divisor is 54, from 54, (borrowing 5 to add to the 4 standing over the 6, and as you mention 6 and 4, dash them out with your Pen) there rests 0; 9 times 3 in the Divisor is 27, and 5 borrowed is 32, from 33, (borrowing 3 Tens to add to the 3 standing over the 3 in the Divisor) and there rests 1, which put over the 3, as you see. Then remove your Divisor a degree towards the right hand, as in the Example, and consider how often 136 you can have in 105, (which is 10 that remained, and 5 next the 4 in the Dividend) the Answer is 0, which put in the Quotient, and taking the next Figure, viz. 6, into the 105, makes 1056; say how often 136 in 1056, or 1 in 10, the Answer is but 7 times; then 7 times 6 is 42, from 46, and there remains 4, which put over the 6, (dashing it out, and also the 6 in the Divisor) saying 7 times 3 is 21, and 4 borrowed is 25, from 25, (borrowing two Tens) and there rests 0, which put down over the 5, saying 7 times 1 is 7, and 2 is 9, from 10 leaves 1, which put over the Cypher as you see, dashing out the Figures in the Divisor as you multiply them, and of the Dividend as you deduct therefrom. Then remove the Divisor, and proceed as before, and as you see in the Example.

But there are two things which render this way of Division inferior in Estimation to the second, i.e. the repeating the Divisor for every Figure put in the Quotient; and also the cancelling the Figures, makes it very difficult to examine your Work in case of a Mistake:

The Illustration and Rationale of the Work of Division.

I shall instance in admitting that 9876543210 were to be divided by 45678.

A Fourth Way of Division; or, The Operation of Division illustrated.

<i>Products of the Divisor</i>			
<i>Divisor.</i>	<i>repeated</i>		
by 1=45678	45678	9876543210	(200000 = first Quote.
2=91356		9135600000	
3=137034	45678	740943210	— 10000 = second Quote.
		456780000	
4=182712	45678	284163210	— 6000 = third Quote.
5=228390		274068000	
6=274068	45678	10095210	— 200 = fourth Quote.
		9135600	
7=319746	45678	959610	— 20 = fifth Quote.
8=365424		913560	
9=411102	45678	46050	— 1 = sixth Quote.
<i>The Tarif.</i>		45678	
		resteth 372	216221 = Sum or General Quotient.

In the beginning of this Part or Section, Division is said to be the Work of many Subtractions, and so it is plain : But then we are taught here how to go a nearer way to work than to deduct the Divisor singly ; for in the first Operation above, we deduct 200000 times the Divisor at one time, (which are all the 100000's of the Divisor that are contained in the Dividend.) At the second Working we deduct 10000 times the Divisor, (which is all the 10000's of the Divisor that is in the Dividend.) The third time we take 6000 times the Divisor from the Dividend, then 200 times, then 20 times, and then 1 time the Divisor from the Dividend : So that by this Art of Division you deduct at 6 times what by Subtraction would require 216221 times to perform.

Now to know how many times the Divisor to deduct the first time, I consider what part or places of the Dividend I can take the Divisor from, and find it the five first towards the left hand ; therefore I mark that, by putting a Point under it, and I consider how often

often the Divisor can be had in those five places, or how often 4 (the first of one) in 9 (the first of the other) and find it 2 times. Now to know what Denomination to give this (2) I consider what place that Figure which I made the Point under possesseth, which being the Hundred thousands, therefore this 2 is 200000: so that multiplying the Divisor by 200000, and deducting the Product from the Dividend, the Remainder is 740943210, which is an absolute new Dividend, to be divided by 45678 the Divisor. So having repeated the Work by the same Rules, at last a Number less than the Divisor remains, so the Work is ended.

And thus by dividing the whole into 6 distinct Dividends, there ariseth 6 Quotients; the Sum of which is the general or true Quotient.

But because Brevity is most commendable in this Art, therefore all superfluous Figures being omitted, as the repeating of the Divisor, the Cyphers at the ends of the Quotients and Subtrahends, the Work is then the same as in the two first Propositions: And if the whole Subtrahends be omitted to be put down, deducting as you gradually multiply the Divisor by the Figure put in the Quotient, the Work is then contracted as much as may be, and will stand as in the Example under the second Way of Division.

The Tarif shews you by Inspection how often the Divisor can be had in each Dividend (without trial or guessing) and the Digits towards the left hand shew what must be put in the Quotient.

The Use of Division.

Farthings, Pence, or Shillings, are immediately reduced into Pounds, by dividing the given Number by 960, 240, or by 20, (as by the second Table in Addition.)

In 157460 Shillings how many Pounds? Cut off Units place, and take half the remaining Figures toward the left hand; and where the Number to be halved is odd, take the less half, and put 10 to the next Figure, &c. Thus $\frac{1}{2}$ of 157460 is £. 7873.

In 1889520 Pence how many Pounds?

$$\begin{array}{r}
 240 \overline{) 1889520} \quad (7873 \text{ Answer.} \\
 \underline{1680} \\
 209 \\
 \underline{175} \\
 072 \\
 \underline{0}
 \end{array}$$

In 7558080 Farthings how many Pounds?

$$\begin{array}{r}
 960 \overline{) 7558080} \quad (7873 \text{ Answer.} \\
 \underline{7680} \\
 838 \\
 \underline{700} \\
 288 \\
 \underline{0}
 \end{array}$$

H

Note,

Note, Farthings are reduced into Pence by dividing by 4, and Pence into Shillings by dividing by 12.

In 7558991 Farthings, how many Pounds, Shillings, Pence, and Farthings?

	<i>d.</i>	<i>s.</i>	<i>l.</i>	<i>s.</i>	<i>d.</i>
--	-----------	-----------	-----------	-----------	-----------

4) 7558991 (1889747 (157478 (7873 : 18 : 11 $\frac{1}{2}$ Answer.

$$\begin{array}{r} \text{---} \\ 35 \\ \text{---} \end{array} \quad \begin{array}{r} \text{---} \\ 68 \\ \text{---} \end{array} \quad \begin{array}{r} \text{---} \\ 20 \\ \text{---} \end{array}$$

35

68

20)

35

89

38

57

29

94

19

107

31

11 Pence rest.

3 Farthings rest.

Example 5. In 3046400 Ounces, how many Ton?

Ounces in a Ton

per Table 1. in

Addition,

35840) 3046400 (85 = Ton Answer.

17920

Example 6. In 158256 Quarts, how many Ton of Wine?

Quarts in a Ton

per Table 3.

$\} 1008) 158256. (157 = \text{Tons of Wine, Answer.}$

5745

7056

These six Examples are the Reverse, and prove the Truth of the six first in the Use of Multiplication.

And as a seventh Example, I shall give the Use of Multiplication and Division, in shewing how to find all the aliquot Parts into which any Number is capable of being divided : and the Use thereof.

Exam-

Sect. 5. *Division of Intire Numbers.* 51

Example 1.] To find how many even Parts into which 360 is divisible. See the whole Operation.

2) 360
2) 180
2) 90
3) 45
3) 15
5

The Divisors and }
last Quote = 2, 2, 2, 3, 3, 5,

— 4, 8,
6, 12, 24, 9,
18, 36, 72,

—
10, 20, 40, 15,
30, 60, 120, 45,
90, 180, 360.

1. I divide the given Number by 2, 3, 5, 7, or other that will divide without a Remainer, and then place the Divisors and last Quote as in the Example.

2. I multiply the 2 next the left hand by the next 2, which produceth 4, placed under the 2, and that Product by the first 2 gives 8.

3. I multiply the 3d (2) the 4, 8, and 2d (3) by the 1st 3, which produceth 6, 12, 24, and 9 placed under the respective Multipliers, (as I do all the rest following.)

4. In like manner I multiply 6, 12, and 24, by the 3, (because that Digit is repeated, otherwise I should have multiplied the 2, 2, 2, 3, and the 4, 8, also by it) and the Products are 18, 36, and 72.

5. I multiply all that is before by 5, (except where the Products would be the same) as 2, 4, 8, and 2d (3) in the first and second Lines, which produceth 10, 20, 40, 15, in the fifth Lines. Also by the same 5 (next the right hand) I multiply 6, 12, 24, and 9, which produceth 30, 60, 120, and 45 in the sixth Line, and 18, 36, and 72 in the fourth Line (of the Numbers above) by the same 5 produceth 90, 180, and 360.

And if there were any more different Digits in the first Line towards the right hand, I should multiply all the above 7 Lines thereby, (where the Products would not be the same, for I omit repeating one and the same Product.) But because the last Number is 360, and cannot therefore be properly said to be a part of the Number given, I therefore omit that, and put 1 always instead of the Number given.

And tho you change the places in the Figure in the first Line, the Answer will be true; as in the subsequent Example will appear, as

by the above Rules the aliquot Parts in the last Example of 360 are found 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 40, 45, 60, 72, 90, 120, and 180.

Example 2.] To find all the aliquot Parts into which 10350 may be divided.

10350 divided by 2 = 5175 ; that by 3 = 1725 ; that by 3 = 575 ; that by 5 = 115 ; that by 5 = 23.

Which Divisors
and the last
Quore are

3, 3, 2, 5, 5, 23 (the 2 being transposed)

9,	= 3 by the 3.
6, 18,	= 3, and 9 by the 2 in the upper Line.
15, 45, 10,	= 3, 9 and 2 by 5 in the upper Line.
30, 90,	= 6 and 18 by 5.
75, 225, 50, 25,	= also the 15, 45, and 10 by said 5 ; it being repeated.
150, 450,	= 30 and 90 by 5, for the same reason.
69, —, 46, 115,	= 3, 2 and 5 in 23, the first in the upper Line.
207,	= 9 in 2d Line by said 23.
138, 414,	= 6 and 18 in the 3d Line by said 23.
345, 1035, 230,	= 15, 45, and 10 in the 4th Line by 23.
690, 2070,	= 30 and 90 in the 5th Line by the 23.
1725, 5175, 1150, 575,	= the 6th Line by 23, the first Number in the first Line.
3450, 10350.	= 150 and 450 in the 7th Line by said 23.

So the even Parts of 10350 are 1, 2, 3, 5, 6, 9, 10, 15, 18, 23, 25, 30, 45, 46, 50, 69, 75, 90, 115, 138, 150, 207, 225, 230, 345, 414, 450, 575, 690, 1035, 1150, 1725, 2070, 3450, and 5175.

Sect. 5. Division of Intire Numbers.

53

The Use of the Rules for finding the aliquot Parts of a Number.

This will appear thus: Suppose I would find all the aliquot Parts of a Pound Sterling, I reduce it to its least Denomination, as 960 Farthings; the aliquot Parts of which are found 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, 30, 32, 40, 48, 60, 64, 80, 96, 120, 160, 192, 240, 320, 480, and 960.

Which Numbers being made Denominators, and 1 the Numerator, there will arise the Parts of Coin following; which being supposed the Price of any Integer, the Value of any Number of them is found

by dividing the Number of Integers by the respective Denominators at once.

2,	2,	2,	2,	2,	2,	3, 5.
—	4	8	16	32	64.	
6,	12,	24,	48,	96,	192.	
<hr/>						
10,	20,	40,	80,	160,	320,	15,
30,	60,	120,	240,	480,	960.	

Parts of a Pound.	s.	d.	Parts.	s.	d.	q.	Parts.	d.	q.
$\frac{1}{10}$	10	—	$\frac{1}{10}$	1	3		$\frac{1}{80}$	—	3
$\frac{1}{12}$	6	8	$\frac{1}{12}$	1	—		$\frac{1}{96}$	—	2
$\frac{1}{15}$	5	—	$\frac{1}{15}$	—	10		$\frac{1}{120}$	—	2
$\frac{1}{16}$	4	—	$\frac{1}{16}$	—	8		$\frac{1}{160}$	—	1
$\frac{1}{20}$	3	4	$\frac{1}{20}$	—	7	2	$\frac{1}{192}$	—	1
$\frac{1}{24}$	2	6	$\frac{1}{24}$	—	6	—	$\frac{1}{240}$	—	1
$\frac{1}{30}$	2	—	$\frac{1}{30}$	—	5	—	$\frac{1}{320}$	—	3
$\frac{1}{32}$	1	8	$\frac{1}{32}$	—	4	—	$\frac{1}{480}$	—	2
$\frac{1}{40}$	1	4	$\frac{1}{40}$	—	3	3	$\frac{1}{960}$	—	1

Example 1. What doth 7358 amount to, at 1d. 1q. each?

192) 7358 (38l. 6s. 5d. $\frac{1}{4}$ = Answer.

1598

62 rest so many 5 Farthings, or 6s. 5d. $\frac{1}{4}$.

Example 2. What doth 31987 come to at 3d. 3q. each?

64) 31987 (499l. 15s. 11d. 1 = Answer.

638

627

Rests 51 being so many 3d. 3q. or 15s. 11d. 1

Note, 1d. 1q. in the first is $\frac{1}{192}$, and 3d. 3q. in the second Example, is $\frac{1}{64}$ of a Pound.

The

The Proof of Multiplication.

This can only be done by Division : as in any of the 6 Examples foregoing, the Products of those in the Use of Multiplication are proved to be true by dividing those Products by the Multiplier, the Quotient is the Multiplicand ; or if you divide the Product by either of the Factors, the Quotient will be the other. But to pretend to prove Multiplication by casting out the Nines, is a Mistake, as I have elsewhere demonstrated ; for why divide by 9 more than 2 or any other Digit, which would prove the Work as well ? But the easiest way is to divide the Factors by 10, and the Product of the Remainders by 10, which will leave a Remainder equal to that of the Product divided by 10. But the mischief is, that if there be a Mistake in the Product of just your Divisor, or any Power thereof, this Way of proving will not shew it.

The Proof of Division.

This is either performed by Multiplication or Division, as appears in the Margin. For Example, I have divided 17002125 by 357, and find the Quotient 47625. And if 17002125 be divided by that Quotient, the latter Quotient will be 357 = the former Divisor. This is proved by Multiplication of the Quotient 47625 by 357 the Divisor. See *Exam. 2. Prop. 2. of Sect. 4.*

$ \begin{array}{r} 357 \overline{) 17002125} \\ \underline{1071} \\ 6291 \\ \underline{2163} \\ 4275 \\ \underline{12825} \\ 0 \end{array} $	$ \begin{array}{r} 47625 \overline{) 17002125} \\ \underline{15825} \\ 11775 \\ \underline{10710} \\ 10650 \\ \underline{10650} \\ 0 \end{array} $	$ \begin{array}{r} 47625 \times 357 \\ \underline{142875} \\ 158250 \\ \underline{17002125} \\ 0 \end{array} $
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SECT. VI. *Of Extracting the Roots of Numbers, called Evaluation.*

- I**N this Section I shall shew,
- I. The Extraction of the Square Root.
 - II. The Extraction of the Cube Root.
 - III. The Extraction of the Biquadrate Roots of Numbers.
- I. The

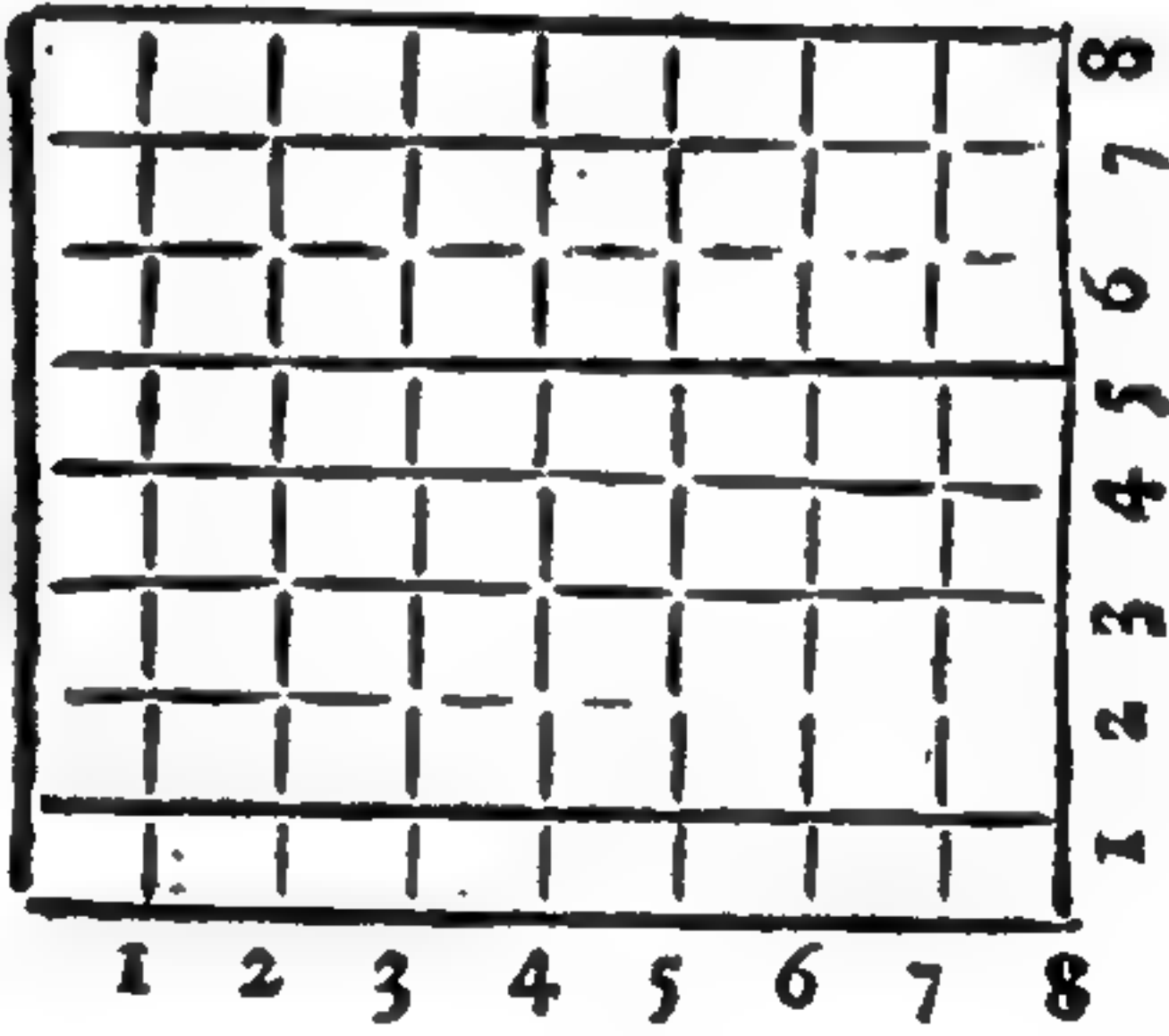
Sect. 6. Of Extracting the Roots of Numbers. 55

I. The Square Root of a Number is such a one, as being multiplied in itself, produceth the Number given ; (for to square any Number, is to multiply it by itself.) Thus the Square Numbers, whose Roots are the 9 Digits, are as follows in the Margin.

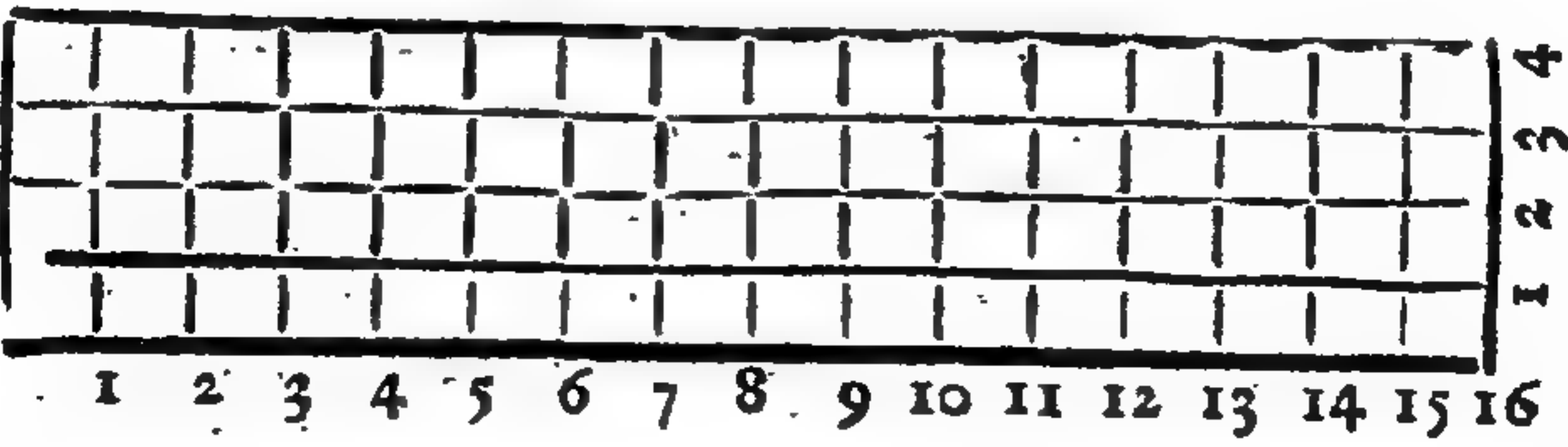
This may be illustrated by any square Superficies, as Glafs, Board, &c. for if the superficial Content of a Square thereof (whose 4 Sides are equal) be 81, then one of the 4 Sides is 9 ; if the square Superficies be 64, then 1 of the 4 equal Sides is 8, &c. as appears by the Table. And the square Figure whose Surface is 64 square Inches, Feet, or other thing ; each Side is therefore 8, which is called the Root of that Superficies, as you see. So that when the Square Root of any Number is demanded, it is as much as to require what the Side of a Geometrical Square is, whose Area (or superficial, or outside Content) is any Number given. Hence it follows, that by extracting the Square

Squares.	Their Roots.
81	9
64	8
49	7
36	6
25	5
16	4
9	3
4	2
1	1

Root of any Superficies, you reduce it to a compleat (or Geometrical) Square. Thus the long Quadratick Figure being 16 in length, and 4 in breadth, the Superficies is upon the flat 64, (or 4 times 16) and the square Root of 64 by the Table above is 8. Therefore a Geometrical Square, one of whose four equal Sides is 8, (as that above) is equal to the long Square, or any other Figure whose flat Surface is 64.



Such Numbers as the above, when the Root may be extracted without



a Remainer, may be called compleat or perfect square Numbers ; but there are abundantly more Numbers, whose Roots cannot be precisely extracted : and these are called imperfect Squares, or Surd Numbers, of which more in Decimals, Logarithms, and especially in Algebra, hereafter treated on.

Question

56 Of Extracting the Roots of Numbers. Chap. I.

Question 1. What is the Square Root of 10274589?

Place the Number so that you may conveniently perform the Work, and point over the first and every second afterward; which Points shew how many places the Roots will consist of.

$$\begin{array}{r}
 \text{Root} \\
 10 \overline{) 10274589} \quad 16 \quad (32054 \\
 \underline{6} \quad 127 \\
 640 \overline{) 34589} \\
 \underline{6410} \quad 256416 \\
 \hline
 0 \text{ remains.}
 \end{array}$$

Then consider what square Number in the foregoing little Table is next to and can be taken from the first Branch towards the left hand of the square Number given, (as here 10;) 9 I find is the next, whose Root (3) I put down (like a Quotient) as you see, and subtracting the Square of 3 (or 9) from 10, there remains 1.

To which Remainder 1 I bring down the two next Figures (27) and divide that 127 (except the Figure next the right hand) by 6, which is double the Root (3) saying the 6's in 12 is 2; put that in the Root, makes it 32. Then square 2, and deduct from 7, (in the 127) and the rest is 3; then multiply 6, the double Root, by 2, and deduct the Product from 12 (in the 127) and there rests 0. The rest is only Repetition.

Then double the Root 32 makes 64, and that is your next Divisor. Then to the 3 bring down the next Branch 45, marking it as you do in Division, and you have 345 for a Dividend.

But because (if Units place, here 5, be excluded) you cannot have 64 in the rest, which is 34; therefore put (0) in the Root, and also in the Divisor, (to 64, as you see) and bring down the next Branch 89, makes a Dividend 34589 to divide by 640. And finding I can have 6 in 34, 5 times, I put 5 in the Root; and squaring 5 (as was taught for the other Figures of the Root) I say 25 from 29, (of the 34589) and there rests 4, and carry 2; 5 times 0 is 0, but 2 from 8 rests 6, and so 5 times 4, proceed as in Division, and the whole Remainder is 2564.

Lastly, To this bring down the last Branch (16) and divide the 256416 by double the Root 3205, viz. 6410, and the Quote being 4, I put it in the Root, and subtracting the Square thereof from 16, (in the 256416) and also the Product of the Divisor thereby, as before shewn, there remains (0) and 32054 is the Answer.

A second Example.

	Square Root.
11473259643	(107113
20) 1473	
214) 2425	
2142) 28496	
21422) 707543	
	64874 refts.

A third Example.

	Square Root.
976543210123	(988202
18) 1665	
196) 16143	
1976) 39921	
197640) 3970123	
	17319 refts.

II. The Extraction of the Cube Root.

The Cube Root of any Number is that whose Square multiplied by the Root, produceth the Cube Number given. Thus the Cube Numbers, whose Roots are the 9 Digits, are as follows.

A Cube is a solid Body bounded by six Geometrical square Superficies's, as a Dye, whose Length, Breadth, and Depth, (or Thickness) are all equal: And to extract the Cube Root of any Number, is to suppose that Number the Content of a Cube in Feet, Inches, &c. given, to find the Side of one of the six Squares that bounds it. So that as the Extraction of the Square Root is chiefly used in measuring and proportioning of Surfaces; so is the Cube Root in doing that of Solids. And as there are Surd Numbers, whose Square Roots cannot be extracted without a Remainder, so it is in Cube, and other Roots.

I shall give but one Example, but 'tis so plainly demonstrated, as may be sufficient to enable any one to extract the Root of any whole Number: And where there are Remainders, I shall shew how to proceed, when I shew the Use of Decimals in extracting the Cube Root.

What is the Cube Root of 32934168093464? The whole Operation follows, with the Name of each Line or how it ariseth.

Cube Numbers.	Squares.	of the Squares Roots and Cubes.
1	1	1
8	4	2
27	9	3
64	16	4
125	25	5
216	36	6
343	49	7
512	64	8
729	81	9

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32	934	168	093	164	(32054 = Cube Root sought.
27					The Cube of 3 (1st in the Root) Deduct.
279	5934				The first Resolvend or Dividend.
	9				The treble Root (3).
	27				Treble the Square of that 3.
	279				Sum, or the first Divisor.
	8				Cube of 2, the second put in the Root.
	36				Squ. of that 2, multip. in last treble Root.
	54				The treble Square of the Root in 2.
	5768				The Sum of the 3 last Lines = a Subtrah.
30816	166	168			{ The 2d Resolvend, being 166, the Rem.
	96				and 168 carry'd down to that.
	3072				Treble the Root 32.
	30816				Treble the Square of that Root.
3072960	166	168	093		Sum, or the 2d Divisor.
	960				The 3d Resolvend.
	307200				Treble the Root 320.
	3072960				Treble the Square of that Root.
	125				Sum, (or the 3d Divisor.)
	24000				Cube of 5 (last put in the Root.)
	1536000				Square of that 5, in the last treble Root.
	153840125				Last treble Square of the Root in that 5.
308170365	123	27968	464		The Sum, or a Subtrahend.
	9615				The 4th Resolvend.
	30816075				Treble the Root 3205.
	308170365				Treble the Square of that Root.
	64				Sum, (or the 4th Divisor.)
	153840				The Cube of 4, last put in the Root.
	123264300				Square of that 4 in the last treble Root
	12327968464				Last treble Square of the Root in that 4
(0) rests.					{ The Sum (or Subtrahend) which de-
					ducted from the last Resolvend,

The Steps in the Performance of the Work of Extraction of the Cube Root are very evident in this last Example : For,

Sect. 6. *Of Extracting the Roots of Numbers.* 59

1. You point over the Figure in Units place, and then over every third Figure, which divides the whole Cube Number into 5 parts; which shews that the Root will consist of 5 places.

2. I find that 3 being cubed, produceth 27, (as appears by the little Table foregoing) which is the next less Cube Number to 32, (the first part towards the left hand) I therefore put the Root 3, in the Cube Root sought as you see, and deducting the 27 from 32, the Remainder is 5.

3. To the Remainder we always bring down the next part, (as here 934) and that makes the Resolvend, which is always the Dividend, in order to find the next Figure in the Root.

4. And to find the Divisor whereby to divide that Dividend, you may observe that it is always composed of the treble Root, *i. e.* 9, and of the treble Square of the Root, *viz.* 27.

5. I find I can have 279 the Sum, in 593 (for the 4 in Units place of the Resolvend 5934, you are in this case to take no notice of) 2 times, which put in the Root makes it 32.

6. The next thing is to frame your Subtrahend, which is always composed, *1st*, Of the Cube of the Figure last put in the Root: *2^{dly}*, The Square of that Figure multiplied in the last treble Root: And, *3^{dly}*, The last treble Square of the Root multiplied in the said Figure last put in the Root: the Sum of which three Numbers, as the Example plainly shews, is the Subtrahend.

7. The Subtrahend must always be deducted from the last Resolvend, as here 5768 from 5934, and the Remainder is 166; to which bring down (as before) the next three Figures (168) and you have a new Dividend (or Resolvend :) all the rest is Repetition of the same Method of working; except here, that you cannot have 30816 in 16616, therefore you put a (0) in the Root, and from that 320 (the Root) you make a new Divisor, which is 3072960; and for the Dividend, you bring down the 3 next Figures (093) to the last Resolvend, and that makes your Dividend 166168093, &c. which is all very obvious in the Example.

III. *The Extraction of the Biquadrate Root.*

The Biquadrate Root is the Root of the 4th Power, as the Cube is that of the 3d, and the Square Root that of the 2d Power, according to the following Table.

Whence it appears, that the second Power of any Number is the Square of it, or Product of any Number by itself; the Cube

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or 3d Power is produced by multiplying the Square of any Number by its Root; the Biquadrate or 4th Power is discovered by multiplying the Cube by the Root, as appears in these nine Examples.

But of the Powers of Numbers to the 10th inclusive, and the proper Name of each, you have a full Account in the Extraction of Roots in Algebra; where the Reason of that abstruse Method of extracting the Square, Cube, Biquadrate, Surfsolid, &c. Roots, is fully explained from the Algebraical Canons for each, both by Numbers and Symbols.

What is the Biquadrate Root of 2998219536?

The Example, with Rules how each Line is produced, follows.

A Table of Powers and their Roots.

The Biquadrate or 4th Powers.	The Cubes or 3d Powers.	The Squares or 2d Powers.	The Root or first Power, viz. of the 2d, 3d, and 4th Powers.
1	1	1	1
16	8	4	2
81	27	9	3
256	64	16	4
625	125	25	5
1296	216	36	6
2401	343	49	7
4096	512	64	8
6561	729	81	9

1. You see that having pointed over Units place, and every 4th place afterwards, the Root will consist of 3 places, as there are 3 points.

2. You must consider what 4th Power in the little Table above is next to and less than the first Part or Branch 29: you see 16 is, whose Root you have there (2); then subtracting the Biquadrate 16 from 29, there rests 13.

3. To that 13, bring down the next Branch or Part 9821, and you have 139821 for a Dividend, of which the Units place must not be considered, in asking how often the Divisor can be had therein.

4. To find the Divisor, you see it is composed, 1st, Of 4 times the Figures then in the Root, (as here 2.) 2^{dly}, Of 6 times the Square of that: And; 3^{dly}, 4 times the Cube thereof: the Sum of which being a Divisor,

5. There ariseth from the Division, 3 in the Root.

6. You must find a Subtrahend, by adding together as the Directions against the 4 Numbers 81, 216, 216, and 96, do express; and subtracting the Sum from the last Resolvend, there rests 19980: to which bringing down 9536, you have 199809536. The rest is only Repetition of the three last Steps, as to Method.

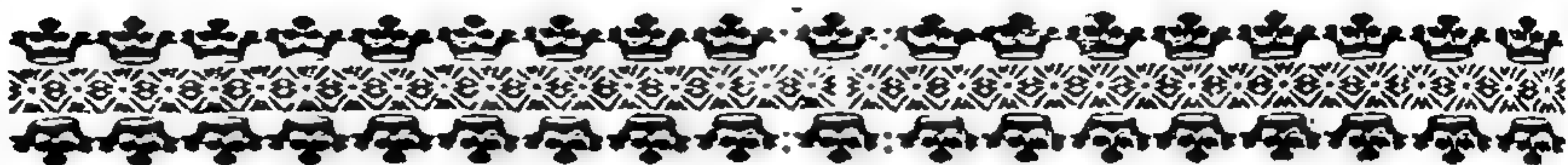
Sect. 6 Of Extracting the Roots of Numbers. 61

29 98219536		(234 = the Biquadrate Root sought.
16	.....	The Biquadrate of 2, 1st put in the Root.
3448)	139821	{ 13 (the Remainer) and 9821 brot. down to it, being the 1st Resolvend or Dividend
	8	4 times the 2 put first in the Root.
	24	6 times the Square of that 2.
	32	4 times the Cube of that 2.
	3448	The Sum of these 3, a Divisor.
	81	The Biquadrate of 3, the last in the Root.
	216	4 tim. the 2 in the Cube of the 3, in the Root.
	216	6 times the Square of 2, in the Square of 3.
	96	4 times the Cube of 2, in 3.
	119841	{ The Sum, or a Subtrahend to take from the last Resolvend above.
4898632)	199809536	A 2d Resolvend, or Dividend.
	92	4 times the 23 in the Root.
	3174	6 times the Square of 23.
	48668	4 times the Cube of that 23.
	4898632	The Sum of the 3 Lines, a 2d Divisor.
	256	The Biquadrate of 4, the last in the Root.
	5888	4 times 23, in the Cube of 4 in the Root.
	50784	6 times the Squ. of that 23, in the Sq. of the 4.
	194672	4 times the Cube of that 23, in the said 4.
	199809536	{ Sum = a Subtrahend, which taken from the Resolvend last above,
		(0) remains.

I know that the Biquadrate Root is the Square Root of the Square Root, and consequently may be performed by extracting the Square Root twice. But this seems a more natural way to perform it, as the Extraction of the Cube, Surfolid Root, &c. may be done from Algebraic Canons, and I have inserted the Method here, because to me it is new ; for I never saw, nor heard of its being done thus before : and I was pleased when I considered it from the 4th Power of $a + b$ in Algebra, which wonderfully, tho plainly, points out all these Rules above, which seem so intricate, as to be impossible first to discover. This Extraction of the Biquadrate Root is useful in some

some Computations of Compound Interest; finding 3 mean Proportionals between 2 Extremes, as in the 5th Head of Geometrical Progression, &c.

The Proof of the Square Root (as appears from the little Table to it) is to multiply the Root in itself; the Proof of the Cube is to multiply that Square in the Root; and of the Biquadrate to multiply the Cube in the Root: for they respectively produce the Number given to have the Root extracted, provided that nothing remain; and if any thing do, add such Remainder.



C H A P. II.

Contains the Application of the Fundamental Parts of Arithmetic, to Vulgar Fractions, Progression, the Rules of Proportion, Practice, Loss and Gain, Fellowship, Barter, Exchange, Equation of Payments, Alligation, and Rules of False Position, in eleven Sections.

S E C T. I. Of Vulgar Fractions.

I.  *NOTATION and Numeration,*] Teacheth what a Fraction is, and how to read or write down any one.

By a Fraction here is meant a broken Number, that is to say, one or more Parts of a Unit; for as there is Infinity of Units, so a Unit may be, or be supposed to be, divided into any Number of Parts.

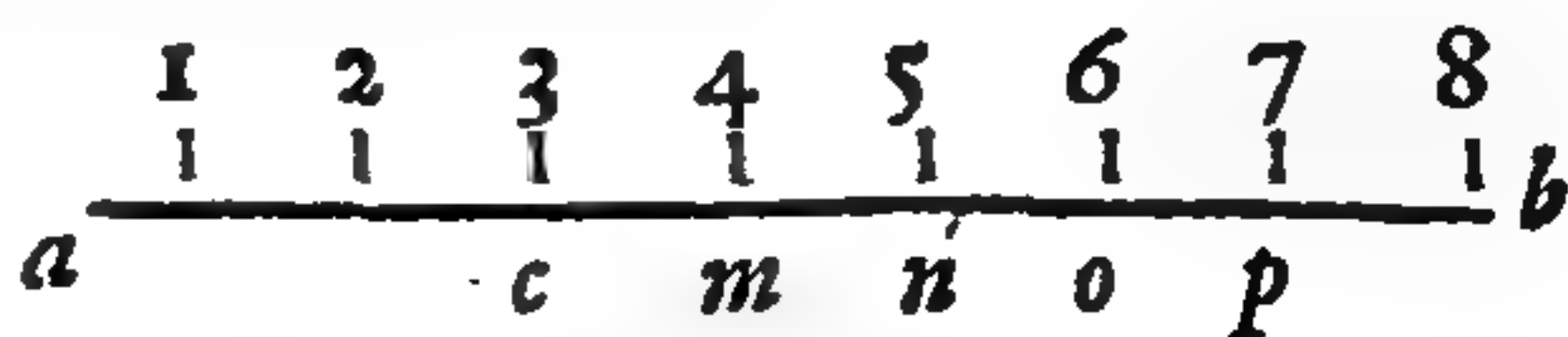
A Fraction consists of two Parts, a *Denominator*, and a *Numerator*: The former shews how many Parts the Unit is divided into, which is wrote below the Line; the latter shews how many of those Parts are contained in the Fraction, which is wrote above the Line; as

$\frac{3}{4}$ of

$\frac{3}{8}$ of a Pound Sterling, or 7s. 6d. here $\frac{3}{8}$ is the Numerator.
 $\frac{3}{8}$ the Denominator.

And these 2 Parts are called the Terms of a Fraction.

Or, to be more plain yet;
 the Line (*ab*) represents 1 or a
 Unit divided into 8 parts, and
 doth represent the said Deno-
 minator of the Fraction given;



and the Line (*ac*) is 3 of those 8 Parts; (*am*) = 4 Eights or $\frac{4}{8}$;
 (*ao*) = $\frac{6}{8}$; (*ap*) = $\frac{7}{8}$, &c.

Having thus shewn
 what a Fraction is,
 you are next to know
 how to read it; and
 that is, by first men-
 tioning the Numerator,
 and then the
 Denominator. As by
 this Example you see
 where 1/12th of the
 Unit (or Line *mn*)
 is wrote thus $\frac{1}{12}$, and
 read One Twelfth,
 &c. $\frac{2}{12}$ = 2 Twelfths,
 &c. But the Line
 might more commo-
 diously be made
 downright, and then

A Table of Simple Fractions.

<i>m</i>	Read thus,
1-12th,	wrote thus $\frac{1}{12}$ One Twelfth.
2-12ths,	..... $\frac{2}{12}$ Two Twelfths.
3-12ths,	..... $\frac{3}{12}$ Three Twelfths.
4-12ths,	..... $\frac{4}{12}$ Four Twelfths.
5-12ths,	..... $\frac{5}{12}$ Five Twelfths.
6-12ths,	..... $\frac{6}{12}$ Six Twelfths.
7-12ths,	..... $\frac{7}{12}$ Seven Twelfths.
8-12ths,	..... $\frac{8}{12}$ Eight Twelfths.
9-12ths,	..... $\frac{9}{12}$ Nine Twelfths.
10-12ths,	..... $\frac{10}{12}$ Ten Twelfths.
11-12ths,	..... $\frac{11}{12}$ Eleven Twelfths.
12-12ths,	..... $\frac{12}{12}$ or 1. Twelve Twelfths.
<i>n</i>	

Fractions would stand as in the Examples next the left hand, where-
 by a Line in printing might often be gained, if $\frac{1}{12}$ were wrote
 1|12; $\frac{2}{12}$, 2|12, &c. But let Custom have its own way; and then
 Fractions are wrote and read as in the foregoing Tabulet, and by
 the same Rule $\frac{1}{17}$ is seventeen 25th Parts; $\frac{365}{1728}$ is 365, seventeen
 hundred and 28 Parts; that is, if a Unit were divided into 1728
 Parts, this Fraction does contain 365 of those Parts.

But there are various kinds of Fractions, as Proper, Improper,
 Simple, and Compound.

A Proper Fraction is one whose Numerator is less than the De-
 nominator, as those above.

An Improper Fraction is when the Numerator is greater or equa
 to the Denominator, as $\frac{7}{3}$, $\frac{7}{7}$, &c.

A Simple or Single Fraction, as any of these foregoing is immediately the Fraction of a whole Unit. But

A Compound Fraction is a Fraction of a Fraction, or Part of another Part of a Unit, as $\frac{2}{3}$ of $\frac{3}{4}$, or $\frac{3}{4}$ of $\frac{2}{3}$, &c. and is illustrated in the following Examples.

Where the whole Line ($l n$) is divided into 10 equal Parts, and each of those are subdivided into two Parts: so that supposing the Unit ($l n$) to be 1 l . each 10th is 2 s . and every half of a 10th is 1 s . so that $\frac{1}{2}$ of $\frac{7}{10}$ is a Fraction of a Fraction, whose Value is 13 s . But the Value here is not intended to be so observable as the Nature of the Compound Fraction; for here $\frac{7}{10}$ is $\frac{7}{10}$ of the Line $l n$, and $\frac{1}{2}$ of $\frac{7}{10}$ is 13 s . for $\frac{1}{2}$ is 2 s . and consequently $\frac{7}{10}$ is 14 s . and $\frac{1}{2}$ of 14 s . must needs be 13 s . Sometimes you have a Fraction of a Fraction of a Fraction, &c. of a Unit, as 1 Farthing is $\frac{1}{4}$ of $\frac{1}{2}$ of $\frac{1}{2}$ of a Pound, &c.

Having thus shewn what a Fraction is, and how to read the same, I proceed to

A Table of Compound Fractions.		
l		s
	$\frac{1}{2}$ of $\frac{1}{10}$ of 1 l . or	1
1	$\frac{1}{10}$ or	2
	$\frac{3}{4}$ of $\frac{1}{10}$. . .	3
2	$\frac{1}{10}$	4
	$\frac{5}{8}$ of $\frac{1}{10}$. . .	5
3	$\frac{1}{10}$	6
	$\frac{7}{8}$ of $\frac{1}{10}$. . .	7
4	$\frac{1}{10}$	8
	$\frac{9}{10}$ of $\frac{1}{10}$. . .	9
5	$\frac{1}{10}$	10
	$\frac{1}{2}$ of $\frac{1}{10}$. . .	11
6	$\frac{1}{10}$	12
	$\frac{3}{4}$ of $\frac{1}{10}$. . .	13
7	$\frac{1}{10}$	14
	$\frac{1}{2}$ of $\frac{1}{10}$. . .	15
8	$\frac{1}{10}$	16
	$\frac{1}{8}$ of $\frac{1}{10}$. . .	17
9	$\frac{1}{10}$	18
	$\frac{1}{2}$ of $\frac{1}{10}$. . .	19
10	$\frac{1}{10}$	20
n		

II. Reduction of Vulgar Fractions.

This Rule must necessarily be taught before Addition and Subtraction, because they cannot be performed till the Fractions given to be added or subtracted, are fitted by Reduction for that purpose.

Case 1. To reduce a mix'd Number to an Improper Fraction. As for Example $12\frac{3}{7}$.

Rule.] Multiply the intire Part by the Denominator of the Fraction, and to the Product add the Numerator (3), and the Sum placed

placed over the Denominator (7) is the Answer, and will stand thus $\frac{87}{7}$.

Case 2. To reduce an improper Fraction to a whole or mix'd Number.

Example, reduce $\frac{87}{7}$.

Rule.] Divide the Numerator (87) by (7) the Denominator, and the Quotient is the intire Number, and the Remainder (3) is the Numerator to place over the Denominator (7); so the Answer is $12\frac{3}{7}$, and proves the first Case true. And by the same rule $\frac{3}{3}$ is $= 7\frac{1}{3}$; $\frac{14}{2}$ is $= 12$; $\frac{8}{2}$ is 9; $\frac{4}{1}$ is 4, &c.

Case 3. To reduce Compound Fractions to Simple.

Example. Reduce $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{7}{8}$ into one simple Fraction.

Rule.] Multiply the Numerators together for a new Numerator, and also the Denominators together for a new Denominator, and it stands thus $\frac{42}{96}$; or this is $\frac{1}{2}$ of $\frac{7}{8}$ or $\frac{7}{16}$, by changing the Parts of the first and second Fractions, and omitting those which are the same; (as 3 in each) and $\frac{1}{2}$ of $\frac{7}{8}$ of $\frac{1}{2}$ of $\frac{1}{2}$ of $\frac{3}{4}$ is $\frac{63}{384}$.

The Truth of this Rule is easily proved from any self-evident Instance, as $\frac{1}{2}$ of $\frac{2}{3}$ of a Pound Sterling is 6 s. 8 d. so by the Rule it is $\frac{2}{3}$. Now $\frac{1}{2}$ being 3 s. 4 d. $\frac{2}{3}$ must be 6 s. 8 d. or $\frac{1}{2}$ of $\frac{2}{3}$ is $\frac{1}{3}$: And if the Parts be changed, and the two of a sort be omitted, it proves the same; and the Reason is plain, for the Terms of a Fraction multiplied by the same Number, does not increase or alter the Value of such Fraction.

Case 4. To reduce a Fraction to its lowest Terms.

Example. Reduce $\frac{36}{45}$ to its lowest Terms.

Rule 1.] Divide the Parts of the Fraction by any Number that will divide both without a Remainder: so this $\frac{36}{45}$ is reduced to $\frac{4}{5}$, for Answer.

Rule 2.] Divide the greater by the lesser Part of the Fraction, and if any thing remain, divide the last Divisor by that; and if any thing yet remain, divide the last Divisor by that, till nothing remain; and then the last Divisor divideth both Parts of your Fraction, so as to reduce it to its lowest Term. See the Work in the Margin, where 9 the last Divisor reduces $\frac{36}{45}$ to $\frac{4}{5}$; so $\frac{144}{72}$ is $\frac{2}{1}$; $\frac{84}{21}$ is $\frac{4}{1}$; and $\frac{315}{15}$ is $\frac{21}{1}$, and $\frac{140}{20}$ is $\frac{7}{1}$, 35 dividing both Parts of the Fraction; found as per the 2d Rule.

$$\begin{array}{l} \text{for } \frac{36}{45} \text{ divided by } 3 \text{ is } \frac{12}{15}, \text{ and} \\ \frac{12}{15} \text{ divided by } 3 \text{ is } \frac{4}{5} \end{array}$$

$$\begin{array}{r} 36 \overline{) 45} \quad (1 \end{array}$$

$$\begin{array}{r} 9 \overline{) 36} \quad (4 \end{array}$$

0

The Truth of this Rule : That a Fraction reduced to its lowest Terms is of the same Value with that given, is thus *proved* ; $\frac{2}{3}$ of a Pound in its lowest Terms is $\frac{2}{3}$ of a Pound, or 13 s. 4 d. And $\frac{1}{3}$ of a Pound being 20 d. 8 times that is 13 s. 4 d.

Case 5. To find the Value of any Fraction of Weight, &c.

Example. What is the Value of $\frac{3}{4}$ of a Pound Averdupois ?

Rule. Multiply the Numerator of the Fraction by such a Number of Units of the next less Denomination, as is equal to a Unit of that name which the Fraction is of, and divide the Product continually by the Denominator, and the Quotient or Quotients answer your Question. See the Work of the following Examples.

Example 2. What is the Value of $\frac{17}{20}$ of a Pound Sterling ?

$$\begin{array}{r}
 17 \text{ Numerator} \\
 20 \text{ Shill. in 1 L.} \} \text{Mult.} \\
 \hline
 26 \overline{) 340} \text{ (13 s.} \\
 \underline{80} \\
 26 \overline{) 24} \text{ (0 d.} \\
 \underline{4 \text{ Farth. in 1 d.}} \text{ Mult.} \\
 \hline
 26 \overline{) 96} \text{ (3 } \frac{2}{3} \text{ Farthings.} \\
 \underline{18}
 \end{array}$$

So the Answer is

s. d. gr.
13 : 0 : 3 $\frac{2}{3}$

Example 1. to Case 5.

$$\begin{array}{r}
 31 \text{ Pounds wt.} \\
 16 \text{ Ounces in 1 lb.} \\
 \hline
 186 \\
 31 \\
 \hline
 42 \overline{) 496} \text{ (11 Ounces.} \\
 \underline{76} \\
 34 \text{ remains.} \\
 16 \text{ Drams in 1 Oun.} \\
 \text{multiply.} \\
 \hline
 204 \\
 34 \\
 \hline
 42 \overline{) 544} \text{ (12 Drams.} \\
 \underline{124} \\
 40 \text{ remains to} \\
 \text{place over the 4s} \\
 \hline
 \text{So the Answer is.} \\
 \text{Oun. Dram.} \\
 11 : 12 \frac{4}{7} \text{ or } \frac{80}{7}
 \end{array}$$

And by the same Rule any other Fraction of Money, Weight, Measure, &c. hath its Value found.

The

The Truth of this Rule is manifest; for suppose $\frac{7}{8}$ of a Pound Sterling we know is 17 s. 6 d. or 7 Half-Crowns; and it will appear to be so by the Rule, if work'd as the two Examples above are.

Case 6. To reduce Fractions of different Denominators to those of the same Value, which have a common (or one and the same) Denominator.

Example. Reduce $\frac{2}{3}$, $\frac{3}{7}$, and $\frac{4}{9}$ to a common Denominator.

Rule.] Multiply the Denominators one in another for the common Denominator, as 9 times 7 is 63, and 5 times 63 is 315 = the common Denominator.

Then for the 3 new Numerators, multiply every Numerator into all the Denominators except its own, and the Product is a Numerator answering to the Fraction whose Numerator you multiplied: as the Numerator 2 in 7 and 9 produceth 70, so is $\frac{70}{315}$ equal to $\frac{2}{3}$. Then 3 multiplied in 9 and 5 gives 135, so is $\frac{135}{315}$ equal to $\frac{3}{7}$. And lastly, 4 multiplied in 7 and 9 is = 252, so is $\frac{252}{315}$ equal to $\frac{4}{9}$. So the 3 new Fractions have each the same Denominator, and are in value the same as those given. So also $\frac{2}{3}$ and $\frac{3}{7}$ are = $\frac{2}{3}$ and $\frac{3}{7}$; $\frac{2}{3}$ and $\frac{3}{7}$ are = $\frac{2}{3}$, and $\frac{1}{11}$, &c.

The Truth of this Rule will be evident by reducing any of the Fractions which have the same Denominator to its lowest Term, and that you'll find the primitive Fraction given: as $\frac{70}{315}$ in its lowest Term is $\frac{2}{9}$ = the Fraction given, and so of all the rest.

This Rule ought to be well minded, it being of principal Use in Addition and Subtraction of Fractions.

Case 7. To reduce Fractions of a smaller Denomination to Fractions of a greater.

Example. What Fraction of a Pound Sterling is $\frac{3}{7}$ of a Farthing?

Rule.] Consider that $\frac{3}{7}$ of a qr. is $\frac{3}{7}$ of $\frac{1}{4}$ of $\frac{1}{2}$ of $\frac{1}{20}$ of a Pound: then reduce this compound Fraction to a simple by Case 3, and you'll find it $\frac{3}{280}$ of a Pound. And by the same Rule $\frac{1}{5}$ of an Ounce is $\frac{1}{320}$ of a Pound, &c.

The Truth of this appears by the next Case.

Case 8. To reduce Fractions of a greater to a smaller Denomination.

Example. What Fraction of a Farthing is $\frac{3}{280}$ of a Pound Sterling?

Rule.] Multiply the Numerator of the Fraction by such a Number of Units of the lesser, as make one of the greater Denomination: So here 960 Farthings making 1 l. I multiply the Numerator 3 in 960, and place the Product for a Numerator to the Denominator of the Fraction given, which makes the Answer $\frac{2880}{280}$ of a Farthing; which Fraction in its lowest Terms is $\frac{3}{7}$, and proves the last Case 7.

to be right. And $\frac{1}{3} \frac{5}{8}$ lb Averdupois is $\frac{2}{3} \frac{4}{8}$ of an Ounce, which in its lowest Term is $\frac{1}{12}$, as above. So that these two Cases 7 & 8, prove the Truth of each other.

III. Addition of Vulgar Fractions.

Example 1. What is the Sum of $\frac{7}{12}$ and $\frac{3}{8}$?

Rule.] Reduce the Fractions to the same Denominator by Case 6. of Reduction, (which you'll find $\frac{5}{8}$ and $\frac{3}{8}$.) Then add the Numerators 56 and 36 make 92, which placed over the common Denominator 96 is $\frac{2}{3}$, the Answer, or $\frac{2}{3}$.

The Truth of this, &c. is thus proved: Suppose the given Fractions be of a Pound Sterling; $\frac{7}{12}$ ths (or 7 times 20 d.) is 14s. 8d. and $\frac{3}{8}$ of a Pound is 7s. 6d. the Sum of which is 19s. 2d. which you'll find to be the Value of the Answer $\frac{2}{3}$, by the fifth Case of Reduction of Fractions.

Example 2. What is the Sum of $\frac{3}{4}$, and $\frac{7}{8}$ of $\frac{2}{7}$ of $\frac{5}{9}$?

Rule.] First reduce the compound Fraction $\frac{7}{8}$ of $\frac{2}{7}$ or $\frac{1}{4}$ of $\frac{5}{9}$ to a single Fraction, which you'll find $\frac{5}{36}$ or $\frac{1}{7} \frac{5}{9}$; to which add the $\frac{3}{4}$, as per Example 1. and you'll find the Sum $\frac{1}{2} \frac{8}{9}$, or $\frac{1}{2}$, (the Answer by Case 3. of Reduction.)

Example 3. What is the Sum of $17 \frac{3}{4}$ and $\frac{2}{3}$ of $\frac{3}{4}$?

Rule.] The compound Fraction in a simple is $\frac{1}{2}$, which added to the Fraction-part of the mixt Number, maketh $\frac{3}{4}$, which by the second Case of Reduction is $1 \frac{1}{4}$ or $1 \frac{1}{4}$; which added to 17, gives the Sum $18 \frac{1}{4}$. *The Truth of which is proved* by supposing $17 \frac{3}{4}$ to be 17s. 9d. and $\frac{2}{3}$ of $\frac{3}{4}$ to be 6d. the Sum of which is 18s. 3d. or $18 \frac{1}{4}$, as above.

IV. Subtraction of Vulgar Fractions.

Example 1. From $\frac{7}{8}$ take $\frac{3}{4}$.

Rule.] The Fractions in a common Denominator are $\frac{7}{8}$ (equal to $\frac{7}{8}$) and $\frac{3}{4}$ (equal to $\frac{6}{8}$) therefore 288 deducted from 736, the other Numerator, the Remainder is 448; so the Answer is $\frac{4}{8}$ (which in its lowest Term is $\frac{1}{2}$, and proves the first Example in Addition of Vulgar Fractions.) And this Remainder (as in Whole Numbers) add to the Subtrahend $\frac{3}{4}$, gives the Sum $\frac{7}{8}$, which proves (that way also) this and the first in Addition of Vulgar Fractions to be truly performed.

Example 2. From $\frac{1}{2} \frac{8}{9}$ take $\frac{7}{8}$ of $\frac{2}{7}$ of $\frac{5}{9}$.

Rule.

Rule.] 1st, Reduce the compound Fractions to a single, which you'll find by the third Case in Reduction to be $\frac{7}{304}$.

2^{dly}, Reduce $\frac{1}{2} \frac{8}{3} \frac{6}{2}$ and $\frac{7}{304}$ to one and the same Denominator by the sixth Case of Reduction, which are $\frac{938448}{1270080}$ (equal to $\frac{1}{2} \frac{8}{3} \frac{6}{2}$) and $\frac{176400}{1270080}$ (equal to $\frac{7}{304}$).

3^{dly}, Deduct the Numerator 176400 from the other Numerator 938448, and the Remainder is 762048: so the Answer is $\frac{762048}{1270080}$. And that in its lowest Terms (by the fourth Case of Reduction) you shall find $\frac{3}{4}$, by dividing each part of the Fraction by the common Measurer or Divisor 254016. *And this proves not only the Truth of the second Example in Addition, but also that this Example is rightly performed.*

Example 3. From $18\frac{1}{4}$ take $\frac{2}{3}$ of $\frac{3}{4}$.

Rule.] 1st, Reduce $\frac{2}{3}$ of $\frac{3}{4}$ to 1 Fraction as before, which is $\frac{1}{2}$.

2^{dly}, Reduce $\frac{1}{2}$ and $\frac{1}{4}$ (the Fraction-part of the mixt Number given) to a common Denominator, which are $\frac{2}{4}$ (equal to $\frac{1}{2}$) and $\frac{1}{4}$ (equal to $\frac{1}{4}$).

3^{dly}, Now you should take $\frac{1}{4}$ from $\frac{2}{4}$, but you cannot, as being less; therefore borrow 1 or $\frac{4}{4}$ from the 18, will leave 17. Then add $\frac{4}{4}$ to the $\frac{2}{4}$, makes $\frac{6}{4}$, from which take the $\frac{1}{4}$, and there remains $\frac{5}{4}$, which in its lowest Term is $\frac{5}{4}$; so the Remainder or Answer is $17\frac{5}{4}$, and *proves* the third Example in Addition. But this is done shorter by omitting the Numerators and Denominators which are the same Digits as $\frac{2}{3}$ of $\frac{3}{4}$ is $\frac{2}{4}$ or $\frac{1}{2}$, &c. as under Case 3. of Reduction.

Which 3 Examples in Subtraction, and those 3 in Addition, do mutually prove each other.

And thus I have given as many Examples as are necessary, in order to the perfect understanding of Addition and Subtraction, which will prove very easy, (as they are so plainly expressed) especially to such as have a due knowledge of Reduction of Vulgar Fractions. I shall therefore proceed to

V. Multiplication of Vulgar Fractions.

Example 1. Multiply $\frac{7}{15}$ by $\frac{9}{10}$.

Rule.] Multiply the Numerators together for a new Numerator, as here 7 by 9 is 63; and the Denominators together for a new Denominator, as 15 by 10 is 150: so that $\frac{63}{150}$ is the Answer.

Example 2. Multiply $\frac{5}{7}$ of $\frac{2}{3}$ by $\frac{7}{8}$ of $\frac{3}{4}$.

Rule.]

Rule.] Work as before ; for the Product of 5 in 2 in 7 and in 8, is 560 the Numerator ; and 7, 3, 8, and 9 together, gives 1512 : so is $\frac{560}{1512}$ the Answer, or $\frac{1}{27}$ in its lowest Terms.

Example 3. Multiply 25 by $\frac{7}{12}$.

Rule.] The whole Number wrote Fraction-ways is $\frac{25}{1}$, which multiply as by the Rule 1. and the Product is 175, (of the Numerators) and that of the Denominators is 12 : so the Answer is $\frac{175}{12}$, or by the second Case of Reduction $14\frac{7}{12}$.

Thus you see in Multiplication of Fractions the Product is less than one of the Factors ; and 'tis so much less, as the Numerator of the Multiplier is less than the Denominator, (in this Example) or so much as 7 is less than 12 its Denominator : for if the Numerator 7 were 12, it's plain that $\frac{12}{12}$ (as is said before) is 1, and 1 time 25 would be 25, which would make the Product equal to the Multiplicand ; and therefore as 7 is less than 12, so must the Product $14\frac{7}{12}$ be less than 25.

Example 4. Multiply $34\frac{7}{8}$ by $13\frac{1}{2}$.

Rule.] Reduce both the mixt Numbers to improper Fractions, and then proceed as by the first Rule in Multiplication of Fractions.

Thus $34\frac{7}{8}$ is $\frac{279}{8}$, and $13\frac{1}{2}$ is $\frac{167}{2}$, and the Product of the Numerators 279 and 167 is 46593, and of the Denominators (96) so the Answer is $\frac{46593}{96}$, or $485\frac{3}{8}$.

VI. Division of Vulgar Fractions.

Example 1. Divide $\frac{53}{15}$ by $\frac{7}{15}$.

Rule.] Place the Fractions as in the Margin ; $\frac{7}{15}) \frac{53}{15} (\frac{945}{1500}$ then multiply the Numerator of the Divisor by the Denominator of the Dividend, and the Product is 1050, the Denominator of the Quotient. And the Denominator of the Divisor in the Numerator of the Dividend produceth 945, the Numerator of the Quotient ; which is therefore $\frac{945}{1050}$, in its least Terms $\frac{9}{10}$: And proves the Truth of the first Example in Multiplication of Vulgar Fractions.

Example 2. Divide $14\frac{7}{8}$ by 25.

Rule.] Reduce the mixt Number to an improper Fraction, and put a Unit under the 25, then work as per the last Rule, and as in the Margin. Where you see the Quotient is $\frac{175}{300}$, or in its least Terms is $\frac{7}{12}$. And this proves the Truth of Example 3. in Multiplication, as that proves this true.

Divisor. Dividend. Quote.
 $\frac{7}{15}) 14\frac{7}{8} \text{ or } \frac{119}{8} (\frac{175}{300} \text{ or } \frac{7}{12}$

Exam-

Example 3. Divide $485\frac{3}{8}$ by $13\frac{1}{2}$.

Rule.] Reduce the mixt Numbers to Fractions, and you'll have $485\frac{3}{8}$ equal to $485\frac{3}{8} =$ the Dividend, $13\frac{1}{2} =$ the Divisor, and $\frac{485\frac{3}{8}}{13\frac{1}{2}} =$ the Quotient; which being reduced to a mixt Number, is $34\frac{7}{8}$, or $34\frac{7}{8}$, the Fraction being in its lowest Terms, (dividing each part by the common Measurer 2004)

$$13\frac{1}{2} \overline{) 485\frac{3}{8}} \quad (34\frac{7}{8}) \quad (\frac{55916}{16032})$$

or $34\frac{7}{8} =$ the Answer.

And this manifestly proves the Truth of the 4th Example in Multiplication of Fractions.

I have in the *Merchant's Magazine* shewn the Reason of all the Rules above mentioned, for Reducing, Adding, &c. Vulgar Fractions; and have not room to repeat that here: but have fully shew'd how one Rule proves the Truth of another, which is a good Demonstration of the Genuineness of all.

VII. To Extract the Roots of Vulgar Fractions.

Rule 1.] You must always reduce your Fraction into its least Terms: for if the Root can be justly extracted in any Terms, it can be so in its lowest. Tho when you can see, as sometimes it happens, that the Roots may be immediately extracted of the Fraction in the Terms given, then you need not reduce it to its lowest. Thus for

Example, The Square Root of the Fraction $\frac{16}{49}$ is $= \frac{4}{7}$, the Answer $= \frac{4}{7}$. And if the $\frac{16}{49}$ had been reduced to its least Terms, they would have been $= \frac{2^2}{7^2}$, whose Square Roots are $\frac{2}{7}$, as before.

Example 2. When the Square Root of a mixt Number is required, as suppose of $56\frac{1}{4}$; reduce the mixt Number to a Fraction, and extract the Root of both Terms as before: so $56\frac{1}{4}$ is $= \frac{224}{4}$, whose Square Root is $\frac{14}{2} = 7\frac{1}{2}$ the Answer, (for the $\frac{224}{4}$ is given in its least Terms) and if you multiply $7\frac{1}{2}$ by $7\frac{1}{2}$, the Product is $56\frac{1}{4}$ for Proof. But

Note, That when a Fraction is given, whose Root cannot be extracted without Remainder, you must reduce it to a Decimal, and proceed to get the Root thereof, as per the Rules and Examples at the End of Decimals; or it may in most Cases be done near enough by Logarithms, as at the end of Sect. 3. of Chap. 6.

II. To extract the Cube Root of Vulgar Fractions. Reduce the Fraction to its least Terms, and then extract the Cube Root of each for those of the Root, unless you can see that the Roots may be imme-

immediately extracted of the Terms given. For example, to get the Cube Root of $\frac{7^2 2^2}{3^3 7^3}$, this Fraction in its least Terms is $\frac{2^2 7}{1^3 3^3}$, whose Cube Root is $\frac{2}{3}$. Or if you had done it without reducing to its lowest Terms, the Roots of the Terms given would be 9 and 15, or $\frac{9}{15}$, which is equal to $\frac{2}{3}$, as before.

For the Root of a mixt Number, reduce it to an improper Fraction, and proceed as by the last Example. But when the Root cannot be accurately enough extracted without trouble, you may proceed by Decimals or Logarithms, as is said above.

Note, That the Use of the Square and Cube Roots you have partly in the two next Sections.

VIII. The Application or Use of Vulgar Fractions.

Quest. 1. Two Bags contain $470\frac{7}{8}$ Dollars, but the greater exceeds the lesser $32\frac{9}{16}$ Dollars : how much is in each Bag ?

Rule.] Subtract the Difference from the Sum, and there rests $438\frac{1}{4}$ Dollars ; half of which is $219\frac{1}{8}$, the Content of the lesser Bag ; to which add the Difference $32\frac{9}{16}$, and the Sum is $251\frac{5}{8}$ Dollars in the greater Bag : *The Sum of which for Proof* is $470\frac{7}{8}$.

Quest. 2. A Brick-Wall contains $1792\frac{3}{4}$ square Feet on the Superficies, how many Rod is that of $272\frac{1}{4}$ Feet to the Rod ?

Rule.] Divide $1792\frac{3}{4}$ by $272\frac{1}{4}$, and the Quotient is $6\frac{508}{77319}$, or $6\frac{45065}{77319}$ Rod for Answer.

Quest. 3. In $846\frac{3}{8}$ Pole how many Yards of $5\frac{1}{2}$ Yards to the Pole ?

Rule.] Multiply the one by the other gives the Answer $4655\frac{1}{8}$ Yards.

Quest. 4. What is the Value of 87 C. — q. 13 lb. at 1 l. 9 s. per C?

Rule.] The Weight is $87\frac{1}{4}$ C. or $\frac{9757}{112}$ C. the Money is $\frac{29}{8}$ l. multiply the Fractions together gives $\frac{28295}{40}$ l. which by the fifth Case of Reduction of Fractions is = 126 l. 6 s. 4 d. 1 q. $\frac{4}{7}$.

Quest. 5. If I give l. 126 : 6 : 4 : 1 $\frac{4}{7}$ for 87 C. o q. 13 lb. of Sugar, what is that per Hundred weight of 112 per C?

Rule.] Divide the Money (as $126\frac{2139}{875}$) by the Weight $87\frac{1}{4}$ C. and the Quotient is exactly l. 1 : 9 : —, the Answer.

And this proves the Truth of the last Question.

Quest. 6. What is the Product of 5 s. 7 d. by 7 s. 5 d?

Rule.] Multiply $5\frac{7}{12}$ s. by $7\frac{5}{12}$ s. (the Pence being so many 12ths of a Shilling) and the Product is $41\frac{59}{44}$ Shillings, or l. 2 : 1 : 4 : 3 $\frac{2}{3}$.

Quest. 7. Divide l. 2 : 1 : 4 : 3 $\frac{2}{3}$ by $7\frac{5}{12}$ Shillings, (or 7 s. 5 d.) The first, in a mixt Number is $41\frac{59}{44}$ s. which divided by $\frac{89}{12}$, ($41\frac{59}{44}$ being

being first reduced to an improper Fraction) the Quotient is $\frac{7 \times 5 \times 5 \times 5}{1 \times 2 \times 2 \times 2}$ or $5\frac{7}{8}$ s. This proves the last Question to be truly wrought.

Quest. 8. What is the Product of $l. 5 : 7 : 10\frac{1}{4}$ multiplied in itself?

Rule.] Reduce the 7 s. $10d. \frac{1}{4}$ into Farthings, and those Farthings into the Fraction of a Pound by the seventh Case of Reduction of Fractions: then you have $l. 5\frac{377}{800}$ to square, (or multiply by itself) which produceth $l. 29 : 1 : 7 : 2\frac{47 \times 4}{2 \times 2 \times 800}$, the Answer.

I should not have inserted this and the sixth Question above, but that there is much noise (tho little real Use) of them; some Persons being deceived by thinking to answer them (for example) by reducing in the 6th Question the 5 s. 7 d. into Pence, and multiplying them by the Pence in 7 s. 5 d. and then reducing the Pence of the Product into Shillings or Pounds by dividing by 12, &c. But this way gives 12 times the Answer, because, as appears, the Pence should be divided by 144, or 12 times 12 = the Product of the Denominators of the Fraction. And so in the last Example they will divide the Farthings in the Product of those in the Number given multiplied in itself by 960; whereas it ought to be divided by the Square of that, viz. 921600.

On the contrary, others think to perform the Work of the sixth Question by reducing the 67 and 89 Pence to the Fraction of a Pound, multiplying $\frac{67}{160}$ by $\frac{89}{160}$. But here 'tis plain the Answer will be so much too little, as $\frac{5963}{73800} l.$ is less than $\frac{5963}{8000} l.$ i.e. it will be but $\frac{1}{9}$ of the true Answer.

Hence it appears, that such Questions are only naturally and accurately resolved by Fractions, as in the said Examples; for which reason I have given those two above in this part of the Use of Fractions, but hope the ingenious Reader will excuse this Digression on so trivial an Instance.

SECT. II. Progression.

THIS Part of Arithmetic, tho neglected both by many Authors of Arithmetical Tracts, and Teachers of the Science, is however of excellent Use, as shewing in a great Variety of Instances the wonderful Power and Harmony of Numbers, and their Relation one to another.

This Relation of Numbers is either Arithmetrical or Geometrical.

I. *Arithmetical Progression*, or Relation of Numbers, is when a Series thereof differ by the Addition of some Number to the first, second, &c. So these Numbers

1	2	3	4	5	6	7	8	9	10	11	12, &c.
2	4	6	8	10	12	14	16	18	20	22	24, &c.
3	6	9	12	15	18	21	24	27	30	33	36, &c.

Each of those in the first Series or Row differ by 1, each of those in the second Series by 2, and in the third by the common Addition of 3. And a Series of abundant Numbers are 30, 42, 54, 66, &c. which differ by 12. Now,

1. To find the Sum of any of the Series's, you must multiply half the Sum of the first and last Terms by the Number of Terms; or half the Number of Terms by the Sum of the first and last, and the Product gives the Sum required.

Thus 1 and 12 is 13 by 6 (half the Terms) gives 78 the Sum.

2 and 24 is 26 by 6, gives 156 = the Sum of the 2d Series.

3 and 36 is 39 by 6, gives 234 = the Sum of the 3d Series.

And the like is to be observed in summing up any other Rows of Numbers, tho never so large, or however differing, if Arithmetically continued.

2. It may be observed, that the several Sums of the three Lines above, or any other of equal Numbers of Terms, beginning with successive Digits continued, do differ also in Arithmetical Proportion; the common Difference being the Sum of the first Series, as 78, 156, 234, &c.

Quest. 1. How many Strokes does the Hammer of a Clock strike in the 12 Hours? This is done as the first Example above, the Answer being 78, and would have been the same had you multiplied half the first and last, viz. $6\frac{1}{2}$ by 12, the whole Number of Terms.

Quest. 2. Admit a Boy is to collect 100 Apples, which lie a Yard distant from each other, and to put each of them singly into a Basket placed one Yard from the first; how many Yards does he pass?

Here the first Term is 2 Yards, the last 200, (to the last Apple, and back to the Basket) Sum 202, which multiplied by 50, (half the Number of Terms) produceth the Sum of the Yards passed by the Boy, which is 10100, or upwards of five Miles.

Quest.

Quest. 3. How many Feet does an heavy Body fall in 11 Seconds of Time, supposing it to fall 16 Foot the first Second, 3 times that the next Second, 5 times that the 3d Second, &c. as in the Example, (or by continually adding 32 to the first Term) the 11th Term is 336 Feet, which the Body falls in the 11th Second, (so prodigious is the Increase of the Velocity :) and if $\frac{1}{2}$ the last and first together be multiplied by the 11, the Sum of all the Feet that it falls is 1936.

<i>The Seconds a Body falls.</i>	<i>Multi- pliers.</i>	<i>Feet an heavy Body falls in each Second.</i>
1	1	16
2	3	48
3	5	80
4	7	112
5	9	144
6	11	176
7	13	208
8	15	240
9	17	272
10	19	304
11	21	336

Thus if you would take the Depth of a Well, or the like, suppose by a Watch that vibrates Quarter Seconds, I find a Stone 44 Quarters or 11 Seconds in falling as above, the Depth of such a Well, &c. is found 1936 Feet.

And in this Progression 'tis plain that any of the Terms are found without the intermediate, by multiplying 16 by double the number of Seconds less 1. Thus I find that it falls in the 8th Second, 240 Feet, by multiplying 16 by 15.

3. To find a mean Arithmetical Proportional between any two Numbers. Take half the Sum of the 2 Numbers or Extremes for Answer, as in the Examples above ; or add half the Difference to the lesser.

- A Mean between 9 and 11 in the first Line is 10.
- 20 and 24 in the 2d Series is 22.
- 27 and 33 in the 3d 30, &c.

4. The common Difference and Number of Terms given to find the last Term. Thus in the 2d Series the Number of Terms (12) being multiplied by the common Difference 2, gives 24, the last Term, &c. or in any Series multiply the Number of Terms less 1 by the common Difference, and add the first Term.

5. Any 2 Numbers standing together given to find a third, &c. Take their Difference, and add to the greater, gives the 3d, &c. Or subtracted from the lesser, gives the lesser Terms, as in the third Series 21 and 24 are given to find the 3d Term ; the Difference is 3, which added to 24 gives 27, the next Term higher ; or subtracted from 21 gives 18, the next Term lower.

6. *If any four Numbers are in Arithmetical Proportion, whether continued or interrupted, the Sum of the two middle Numbers are equal to the Sum of the two Extremes.* Thus

In the first Line 7, 8, 9, 10 ; 7 and 10 are equal to 8 and 9:

Also in 7, 8, 14, 15 ; 7 and 15 are equal to 14 and 8.

And in the 3d Line 12, 15, 18, 21 ; 12 and 21 are equal to 15 and 18.

7. *If three Numbers are in Arithmetical Proportion continued, the Double of the Mean is equal to the Sum of the two Extremes, as 12, 15, 18 ; 2 times 15 is equal to 18 and 12.*

8. *If three Numbers are given, a fourth may be found, by adding together the 2d and 3d, and from that Sum subtracting the first, as in 14, 15, 16, the Sum of 15 and 16 is 31, from which take 14, and the Remainder is 17, the 4th in Arithmetical Proportion ; and this also holds, tho the Progression be interrupted, as 14, 15, 25, 26.*

9. *The Total of the Progression, and the first and last Terms given, to find the Number of Places ; divide the Total by half the Sum of the first and last Terms, and the Quotient is the Number of Terms or Places.*

10. *The last Number and common Difference given, to find the Number of Terms ; divide the last Number by the Excess or common Difference.*

11. *The Sum of the Progression, and the first and last Terms given, to find the common Difference.* Divide the Total of the Progression by half the Sum of the first and last Terms, and the Quotient is the Number of Terms. Then from the last Term take the first, and the Remainder divide by the Number of Terms less 1, and the Quotient is the Excess or Difference sought, as will appear by any of the three Series's above.

The Reason of the Rule for summing up an Arithmetical Progression. According to the 3d Proposition last above, half the Sum of the two Extremes is an Arithmetical Mean ; and a Mean between the first and last Terms of a Progression, according to the same Rule, is found by the first Proposition : and since that is a Mean between the extreme Terms, therefore that being multiplied by the Number of Terms, must necessarily give the Total of them all.

Or more plainly : Take any odd Number of Terms in the three Series's above, and you'll find that Term standing in the middle to be the Mean, according to the said 3d Prop. Thus in the seven first Terms in the second Series, the Mean (or middle Number) is 8, there being three on each side ; so that one with another, each Term.

Term is 8, as you'll find it : for 6 (the next towards the left hand) is 2 less than 8, but then 10 (the next towards the right hand) is 2 more than 8 ; and 4 (the 2d towards the left hand from the 8) is 4 less than 8 ; but then 12 (the 2d toward the right hand from 8) is 4 more than 8 : so lastly, 2 (the 3d toward the left hand from the 8) is 6 less than 8 ; but then 14 (the 3d toward the right hand) is 6 more than 8. So that nothing is more plain, than that each Term (one with another) being 8, that multiplied by the Number of Terms must give the Sum of all the Terms (or Eights :) so the Sum of 7 of the Numbers of the 2d Series aforesaid is 56 (or 7 times 8.) And so of any other Series, grounded on the first Prop. above.

Geometrical Progression.

This is when a Series of Numbers are increased by a continual Multiplication of the first Term, and the Products arising, by some certain Number, called the Ratio or common Factor : as

1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024.

3, 9, 27, 81, 243, 729, 2187, 6561, 19683, &c.

4, 16, 64, 256, 1024, 4096, 16384, 65536, &c.

Prop. 1. To sum up any Series of Numbers, whose Relation is in a Geometrical Progression.

The first Way to find the Total of a Geometrical Progression.

Rule.] Multiply the last Number by the common Multiplier.

2dly, From that Product deduct the first Number.

3dly, Divide the Remainder by the said Multiplier less one ; and the Quotient is the Sum sought.

The Example shall be in the finding the Aggregate of the middle Series above, the last Number whereof is 19683 ; which multiplied by the common Multiplier is 59049, from which take the first Term of the Progression (3) rests 59046, which divide by the said Multiplier less (1) viz. by 2, and the Quotient is 29523 = the Sum required.

The second and much briefer Way to find the Total of a Geometrical Progression, without many of the intermediate Terms, or the last Term being given.

Consider that in the Series of the last Example or middle Series there are 9 Terms ; therefore if you multiply the 5th (or 243) by itself,

self, it will at once produce the 59049 as before, (which would be the 10th Term, if the Progression had run so far) whence the Sum is found as above. For,

Note 1. That when the Number of Terms are odd, and the first is above a Unit, the Square of the middle Term gives that next above the last Term, as in the last Example.

Note 2. If the Number of Terms be odd, and the first Term be but a Unit, then the Square of the middle Term gives the last Term of the Progression, as in the first Series the Square of 32 is the last Term = 1024.

Note 3. If the Terms be an even Number, and the first Term be One or Unity; then the Square of the Sum in the place of half the Number of Terms gives the last Term save one: as in the 10 first Terms of the first Series, the Square of the fifth Term (16) gives $256 =$ the last of the 10 Terms but one.

Note 4. If the Number of Terms be even, and the first Term be more than a Unit, then the Square of the Sum in the place of half the Number of Terms, gives the last Term of the Progression, as in the third Series the Square of 256 is the last Term 65536.

These Rules are more particular and useful in the summing up all kinds of Geometrical Progressions than I have any where observed to be exhibited, and therefore worth noting; for they always hold, as in the two Series's above; and where the Nature of the Progression is as in the first Rank or Line; as is thus farther demonstrated:

0,	1,	2,	3,	4,	5,	6,	7,	8,	9,	10
1,	2,	4,	8,	16,	32,	64,	128,	256,	512,	1024

The upper Series being Arithmetical, the Addition of any two, or Double of any one, shews respectively what is produced by multiplying or squaring those under them in the lower Line. Thus 4 doubled gives 8 in the upper Line, under which stands 256, or the Square of the Number under the 4, &c. So any 2 added in the upper Line, as 3 and 6, give 9: which stands over the Product of the 2 Numbers 64 and 8, which is 512.

The Reason of the Rule for summing up a Geometrical Progression.

It will be the more easily understood by a Series of a few Terms. Thus if I would know the Sum of 4 and 8, it is 4 (or the first Term) less than the last Term 8 multiplied by the common Factor

(2) which plainly shews why you deduct the first Term (here 4.) So also in 2, 4, 8, the Double of 8 is 2 (or the first Term) more than the Sum 14, and therefore from the 16 must be deducted the first Term (2.) Lastly, in 1, 2, 4, 8, twice 8 (the last Term) is 16, which is the first Term (1) more than the Sum (15). And this is sufficient to shew the Reason why we multiply the last Term by the common Factor, and why from the Product the first Term is deducted.

Now, as when the Ratio or common Factor is (2) the Sum of the Progression is $\frac{2}{1}$ the last Number after the first is deducted from the Product; so when the common Factor is 3, the Answer is $\frac{3}{2}$; if the common Factor be 4, the Answer is $\frac{4}{3}$ of the last Number (or Term) having before Division the first Term deducted from the Product. Thus in 3 and 9, the Sum is 4 three's, or 12, which is thrice the last Term (9) less the first Term (3) divided by 2. So also in 4 and 16, the Sum is 4 times 16; less the first Term (4) dividing the Remainder by 3; as might easily (from so few Terms) at first be discover'd. But see more at the end of this Section.

Quest. 1. A King of much Virtue and Valour, admirably esteem'd by his Subjects, returning from the Wars with Victory and Peace, very much Emulation appear'd who should exceed in Demonstrations of Joy. Among the rest, the Governour of the Fortres intending to signalize himself, orders his Sub-Officers to make so many Discharges of Cannon; viz. 3 for the first Year of the King's Age, (which was 25 Years) 9 for the second Year, 27 for the third Year, &c. (not considering the Impossibility of the Performance) the Question is, how many Discharges were to be made, and how much Powder consumed, supposing the Guns to be each a Culverin, whose Requisite of Powder is lb 10?

The 13th Term 1594323 } Mult.
 Ditto . . . 1594323 }

4782969
 3188646
 4782969
 6377292
 14348907
 7971615
 1594323

This is the 26th
 Term (or the next
 above the last) per
 Note 1. foregoing.

The first Deduct. 3

Rems = 2541865828326

Half of which is = 1270932914163,
 the Sum of the Progression, or the
 Number of Discharges order'd.

Which, at 10 Pound of Powder at each Discharge, gives
 12709329141630 lb. at 100 lb. each Barrel, is 127093291416 $\frac{3}{10}$
 Barrels; which would lade 14184965 Ships, at 400 Ton each Ship.

Quest. 2. On the same Occasion
 all the Bells in the King's Metro-
 polis were directed to ring as many
 Changes as they were capable of.
 Now there being 10 Churches, 1
 of which had 2 Bells, another 3,
 &c. the last 10 Bells; how many
 Changes could be rung on all the
 Bells at each Church, and what
 the Sum Total of all that Pro-
 gression?

The Number of Bells multi-
 plied (any way) one in another,
 gives the last Term, or Changes
 that can be rung thereon. Then for the Sum, multiply the last
 Term by the correspondent Number of Bells, and divide the Pro-
 duct

Years. Dischar.

1st ——— 3
 2d ——— 9
 3d ——— 27
 4th ——— 81
 5th ——— 243
 6th ——— 729 }

6561

1458

5103

12th Term }
 by Note 4. } 531441

3

13th Term . . . 1594323

duct by the Number of Terms, and the Quote is *the Answer for four Bells*: For 5 Bells add 2 to the Rule, for 6 add 8, for 7 add 32, for 8 Bells add 152, for 9 add 872, and for 10 add 5912, gives the Sum of the Progressions, here 4037912.

Note, The 2 is the first Term, the 8 the Sum of the 2 first, the 32 = the 3 first, the 152 = the 4 first, the 872 = the 5 first, and the 5912 = the Sum of the 6 first Terms.

Quest. 3. Any Line or Number given, to divide the same into extreme and mean Proportionals. To the Square of the whole Line or Number given, add $\frac{1}{4}$ of that Square; extract the Square Root of the Sum, from which Root deduct half the Line or Number given, and the Remainder is the greater part. And for a Proof, the Rectangle or Product of the whole Line by the lesser part, is equal to the Square of the greater part, by *Euclid* 11. 2.

4thly, If three Numbers be given in Geometrical Proportion continued, the Product of the two Extremes is equal to the Square of the Mean, as 5, 20, 80, equal to 400.

5thly, If two Numbers be given, it follows from the last, that a mean Proportional may be found by multiplying them together, and extracting the Square Root of the Product. Thus in the last Example 5 times 80 is 400; the Square Root of which is 20 = the Mean sought.

6thly, If you would find two Geometrical mean Proportionals between two Numbers given, as suppose between 5 and 320, you must divide the greater by the less; then extract the Cube Root of the Quotient; lastly, by that Root multiply the first Term, gives the first Mean, which multiply by the said Root gives the second, so is 5, 20, 80, 320, the Numbers in order, 20 and 80 being the Means required.

7thly, Or three mean Proportionals may be found thus: Suppose between 5 and 1280. Divide the greater Extreme by the lesser, extract the Biquadrate Root of the Quotient, and by that Root multiply the lesser Extreme continually 3 times; so will the Answer be found 5. 20. 80. 320. 1280.

8thly, If four Numbers be given in Geometrical Proportion, the Product of the two Extremes is equal to that of the two Means: so in the last Example 5 times 320 is equal to 20 times 80, viz. 1600.

9thly, If two Numbers be given, a third in Geometrical Proportion may be found by dividing the greater by the lesser, and multiplying such greater by the Quotient. As per the 5th, 80 is found

in proportion as 5 to 20; for as 5 to 20, so is 20 to 80, as may be proved by the 3d or 6th Cases above.

10thly, Three Numbers given in Geometrical Proportion, a fourth may be found by multiplying the second and third together, and dividing the Product by the first: as in the 5th 20 times 80 is 1600, which divided by 5, gives the 4th Proportional 320. This last is the Foundation of the Rule of Three Direct, which is the next thing to be taught after I have shewed

The Process for finding out the Canon whereby to discover the Sum of a Geometrical Progression.

But first note that

$\{$ shews a Geometrical Proportion.

— signifies less.

= signifies equal to.

x signifies multiplied in.

And in the Literal Work,

f the first Number of the Progression.
r the Ratio or common Factor.

u the Sum of the Progression,
which is unknown.

l the last Term of the Progression.

The Sum of the Progression to be found is this Example,

1, 2, 4, 8, 16, 32.

Literally performed.

$$\begin{aligned} f \cdot fr :: u - l \cdot u - f \\ fu - ff = rfu - rfl \\ u - f = ru - rl \\ ru - u = rl - f \\ u = \frac{rl - f}{r - 1} \end{aligned}$$

Numerally performed.

$$\begin{aligned} \text{that is } 1 \cdot 2 \times 1 :: u - 32 \cdot u - 1 \\ \text{that is } u - 1 \times 1 = 2 \times 1 \times u - 32 \times 2 \times 1 \\ \text{that is } u - 1 = 2 \times u - 2 \times 32 \\ \text{that is } 2u - u = 2 \times 32 - 1 \\ \text{that is } u = \frac{2 \times 32 - 1}{2 - 1} = \text{the Answ.} \end{aligned}$$

So that 'tis plain the Answer is (2) the Ratio multiplied in (32) the last Term, made less by (1) the first Term, and that Remainder divided by (2) the Ratio, less 1, the Quotient is (63) the Sum of the Progression (or u): And this Canon (or Rule) holds in all Geometrical Progressions continued. Which the Reader will more easily apprehend, when he comes to the Algebraic Part, and till then he may pass this, if he finds it difficult to understand; but I could not well omit it in this place, to which it most properly belongs.

SECT.

SECT. III. Rules of Proportion.

IN this Section I shall shew the Operation, 1. Of the single Rule of Direct Proportion. 2. The single Rule of Reverse Proportion. 3. The double Rule of Direct Proportion. 4. The double Rule of Reverse Proportion. 5. The Rule of Proportion by 5 Numbers Direct. 6. The double Rule by 5 Numbers Reverse. 7. A third Variety thereof. 8. Duplicate Proportion Direct. 9. Duplicate Proportion Reverse. 10. Triplicate Proportion. 11. Harmonical Proportion. And, 12. Sesquiplicate Proportion.

I. The Single Rule of Direct Proportion.

This Rule has its Foundation from the 8th and 10th Propositions last foregoing, and is demonstrated by *Euclid* in the 16. 6.

The main difficulty is to state the 3 Numbers given right; for there are always 3 given to find a 4th, and hence some call this *the Rule of 3*; others, because of its great Use, have termed it *the Golden Rule*: and 'tis called *the Rule of Proportion*, because the Number sought bears such Proportion to the 3d, as the 2d does to the first of the Numbers given.

For the right disposing or placing the 3 Numbers given.

Rule.] There being always 2 of one Denomination, and 1 of another, put the last mention'd down first: 2dly, Put that towards the left hand thereof which has dependance on it: and, 3dly, Put the other next the right hand. Thus if the Interest of 1.750 were sought for a Year at the Rate of 5 per Cent. it appears by the State in the Margin, that only 1 of the 3 given Numbers is Interest, therefore I place that in the middle. And because 100 has dependance on it (as being its Principal) therefore I put 100 towards the left hand, and the 3d toward the right hand (in course.)

1. Princ.	1. Inter.	1. Princ.
100.	5	750
1	:	5
	:	
		3750
		1

37.5% Answer.

To find the 4th Proportional, or Answer to the Question.

Rule.] Multiply the 2d and 3d (or those towards the right hand) together, and divide the Product by the first (or that next the left hand) and the Quotient is the Answer, or the 4th Proportional sought for. So in the

Example above, the 4th Proportional is $37\frac{5}{11}$ for 100. $5 :: 750. 37\frac{5}{11}$, that is, as 100 is in proportion to 5, so is 750 to $37\frac{5}{11}$. So that you may prove this Rule by comparing the Product of the 1st and 4th with the Product of the 2d and 3d; as by the sixth last mention'd Prop. in Geometrical Progression.

Case 2.] When the first Number is a Unit only, the Work is done by Multiplication alone.

Thus if 1 Piece of Broad-Cloth cost 17*l.* what will 71 cost? Here the 4th Number is found 1207*l.* which is the 4th Proportional sought.

Pc.	l.	Pc.	l.
1	17	::	71. 1207
			<u>17</u>
			497
			<u>71</u>
			1207

2dly, If I give 3*s.* 9*d.* for an Ell of Holland, what will 1371 $\frac{1}{4}$ cost at that rate?

By the Rule above the Question is stated as in the Margin, and you may multiply $1371\frac{1}{4}$ by 3*s.* $\frac{9}{12}$, as in the 4th Example of Multiplication of Fractions, and the Answer is $493\frac{5}{8}$ Shillings; which, by the 5th Case of Reduction of Vulgar Fractions, is $l. 257 : 2 : 7 : 3\frac{1}{2}$, as per Margin. But these Questions are sooner solved by Practice, as per the next Section.

Ell	s.	d.	Ells
1.	3	9	:: 1371 $\frac{1}{4}$

96) 493695 (5142*s.*

136

409

255

63*s.* Rem.

12 Mult.

96) 756 (7*d.*

84*d.* Rem.

4 Mult.

96) 336 (3*q.* $\frac{4}{8}$

48

Case 3.] When the 3d Number is only a Unit, the Question is answered by Division. Thus if I give $l. 257 : 2 : 7 : 3\frac{1}{2}$ for 1371 $\frac{1}{4}$ Ells of Holland, what is that per Ell?

The Question is thus stated: and being divided (as per the first Example of Division of Vulgar Fractions) the 2d by the 1st, the Quotient is $\frac{3949550}{1053212}$ *s.* which by the said 5th Case of Reduction of Vulgar Fractions is 3*s.* 9*d.* and proves the Truth of the last Question.

Note, That where the first, or third Number, or both, are of diverse Denominations, you must reduce both such 1st and 3d into the least Name mentioned in either, and then

then multiply by the second Number in the lowest Denomination that is in it when given. And then having divided by the first,

Note, 2dly, That your first Quotient will always be of the same Denomination with the lowest mention'd and given in your second Number. To illustrate these three Cases,

Case 4.] If I give $l. 7$ for the Interest of $l. 100 : 10 : —$: what must I give for the Interest of $l. 30$ for the same time? See the

Work in the Margin, where the 1st and 3d be reduced to Shillings (that being the least Term in the 1st Number) yet the Answer retains the same Denomination with the 2d Number, and is $l. 2 \frac{1}{2}$; or by the 5th Case of Reduction of Vulgar Fractions $l. 2 : 1 : 9 \frac{1}{2}$ prope.

Case 5.] If I give $7l.$ for 30 Ounces of Silver, what will 7 Ounces and 10 Penny-weight cost at that rate?

Here it's plain that because the $7 \text{ } \frac{3}{4} \text{ } 10 \text{ dw.}$ are reduced into Penny-weight, the $30 \text{ } \frac{3}{4}$ must be so too: Also that the Quote is of the same Denomination with the 2d Number, viz. $l. 1 \frac{3}{4}$; or, being reduced as aforesaid, $l. 1 : 15$.

Prin.			
$l. \quad s.$	$l. \text{ Int.}$	$l. \text{ Prin.}$	
$100 : 10.$	$7 ::$	30	
20		20	
<hr/>		<hr/>	
2010 Shil.		600 Shil.	
		7	
		<hr/>	
		$2010) 4200 (2l. \text{ In-}$	
		$\underline{\quad} \quad \underline{\quad} \text{ ter.}$	
		<hr/>	
		18	

$\frac{3}{4} \text{ } l.$	$\frac{3}{4} \text{ } dw.$
$30. \quad 7 ::$	$7 : 10$
20	20
<hr/>	<hr/>
600 dw.	$150 \text{ Penny-weight.}$
	7
	<hr/>

$$600) 1050 (1l.$$

$$\underline{\quad} \quad \underline{\quad}$$

$$450$$

$$20$$

$$600) 9000 (15s.$$

$$\underline{\quad} \quad \underline{\quad}$$

$$30$$

$$0$$

Case 6.] If 25 Ounces of Ambergrease cost $l. 52 : 6 : 8$, what will 2 Ounces cost?

See

See the Operation, where the 2d Number in its least Denomination being 12560 Pence; therefore the Quote 1094 is Pence.

$$\begin{array}{r}
 \begin{array}{ccccccc}
 3 & 1 & 5 & 4 & 3 \\
 25 & 52 & 6 & 8 & 2 \\
 & 20 & & & \\
 \hline
 & 1046 & 5 & & \\
 & 12 & & & \\
 \hline
 & 12560 & \text{Pence} & & \\
 & 2 & \text{Ounces} & \} & \text{Mult.} \\
 \hline
 25 \overline{) 25120} & (1004\frac{2}{5} & \text{Pence.} \\
 & 120 & \text{or } 1.4 : 3 : 8\frac{1}{2} & \text{the Answer.} \\
 & \hline
 & 20 & &
 \end{array}
 \end{array}$$

II. The Single Rule of Proportion Reverse.

This teaches, upon a due stating of the 3 Numbers, to find a 4th; which shall bear such a Ratio to the 2d, as the 1st does to the 3d Number.

Quest. 1. How much Matting of 2 Foot broad will line a Gallery which is 7 Foot broad and 40 Foot long?

To state a Question in this Rule,

1. Put down the Number which has the same Denomination as that required.

2. Towards the left hand put down that Number which is joined in the Sense of the Question to the last.

3. Put down the other which has the same Denomination as that towards the left hand.

Then to find the Answer by this,

Rule.] Multiply the 2 next the left hand one in the other, and divide the Product by the 3d, or that next the right hand, and the Quotient is the Answer.

Hence the Reason is evident why this Rule is said to be Reverse: because the lesser the 3d Number is, the greater is the 4th; but in Direct

$$\begin{array}{r}
 \begin{array}{cccc}
 \text{broad.} & \text{long.} & \text{broad.} & \text{long.} \\
 7. & 40. & 2. & 140 \\
 & 7 & & \\
 \hline
 2 \overline{) 280} & (140 & \text{the Answer.}
 \end{array}
 \end{array}$$

And as 140. 40 :: 7. 2

Direct Proportion: the greater the 3d is, the greater is the 4th Number.

So that by this Rule it's easy to know when a Question is to be solved as Direct, and when 'tis Reverse: For when the 3d Number is less than the first, and yet requires more than it does, or being more, requires less than the first requires; in these Cases your Proportion is Reverse, and so you are to work by the last Rule.

Examp: 2.] How much Ground in length, being 12 Perches broad, will make an Acre?

To do this, consider that 4 Perches in breadth requires 40 in length to make an Acre; therefore state and work as per Margin.

4.	40.	12.
	4	

12.)	160	(13 $\frac{1}{3}$ Perches long,
	40	for Answer.

	4	

But altho Writers have prescribed the foregoing Method for stating a Question, as being very natural, and thereby have made it necessary to make this a different kind of Operation and Proportion; yet I shall shew

How to reduce Questions commonly said to be in Reverse Proportion into Direct.

And this is only to consider (to instance in the last Example).

That as (12) the Breadth on which the Answer depends,

Is to (4) the Breadth belong-

ing to the Length given :: Breadth. Bread. Length. Len.

So is (40) the Length given, 12. 4 :: 40. 13 $\frac{1}{3}$

To (13 $\frac{1}{3}$) the Length required.

Here the 4 Numbers are in Direct Proportion, because the Product of the 2 Means is equal to that of the 2 Extremes; which by the by serves for Proof of this Direct Proportion. But in the Reverse the Product of the 1st and 2d is equal to that of the 3d and 4th Numbers; which proves the Reverse Proportion.

III. The Double Rule of Direct Proportion.

This is when a Question requires to be twice stated, and has two such Operations, as under the single Rule. For example,

If I give 5 l. for the Interest of 1. 100 for one Year, what Interest will 1. 700 gain at that rate in seven Months?

1st say, If £100 require £5, what will £700 require in the same time?

You find as *per* the Margin that it will gain £35.

$$\begin{array}{r} \text{£} 100 \quad \text{£} 5 \quad \text{£} 700 \\ 100. \quad 5 :: 700 \\ \hline 5 \\ \text{£} 3500 \end{array}$$

2dly say, If 12 Months require £35, what will 7 Months require? Work and you find the Answer £20 $\frac{1}{2}$, or £20 : 8 : 4.

And by the same Rule you may find the Interest of any Sum for any Number of Days; as suppose £700 for 119 Days.

For a Year, by the first Operation, the Interest is £35:—then in the second Working say, if 365 Days requires £35, what will 119 Days require? You'll find the Answer to be £11 : 8 : 2 : 2 $\frac{1}{2}$.

IV. The Double Rule of Reverse Proportion.

This is also performed at two Operations, the first Direct, the latter Reverse. For instance,

What Principal will gain £20 $\frac{1}{2}$ in 7 Months, at the Rate of 5 per Cent?

The 1st Answer is, that Principal will raise the 20 $\frac{1}{2}$ in a Year.

The 2d, or Answer to the Question, is, That £700 is the Principal that will raise the Interest £20 $\frac{1}{2}$ in 7 Months: by multiplying the 2d Number by 12, and dividing by 7. Note, This proves the first Question in the third Head above.

V. The Rule of Proportion by 5 Numbers Direct.

This Rule hath 5 Numbers given to find a 6th. It is the same with the double Rule of Proportion Direct; only whereas that was done

done by twice stating the Question, this is done by one stating: the Rule for which is to place the 5 Numbers as followeth. Where it's obvious, That the 3d must be of the same Denomination with that sought; the 1st and 2d are the 2 on which the 3d depends: so that the 4th must be of the same Denomination with the 1st, and the 5th the same with the 2d.

Example.] What is the Interest of £ 700 for 7 Months at the Rate of 5 per Cent. per Ann? By the Work in the Margin, you see

<i>l. Prin.</i>	<i>Time.</i>	<i>l. Int.</i>	<i>l. Prin.</i>	<i>Time.</i>
100.	12.	5.	700.	7
12			7 multiply.	

1200 = the Divisor.

4900 } multiply.
5

1200) 24500 (20 $\frac{5}{12}$ = the Answer.
|— · |—

The Rule for the Operation is, Multiply the 3 Numbers next the right in each other for a Dividend, and the 2 next the left hand for a Divisor, and the Quotient is the 6th Proportional sought; as appears in the Method, by double stating under Head III.

And to prove this; The Product of the 1st, 2d, and 6th, is equal to that of the 3d, 4th, and 5th.

Quest. 2.] If 1000 Men in 24 Hours can dig a Trench 18 foot broad, 9 deep; and 500 long; what length of the like Trench can 9800 Men dig in 10 Hours? The Answer as per Margin, is 2041 $\frac{2}{3}$ Feet.

<i>Men.</i>	<i>Hours.</i>	<i>Feet.</i>	<i>Men.</i>	<i>Hours.</i>
1000.	24.	500.	9800.	10.
24			10 multiply.	

98000 } multiply.
500

24000) 49000000 (2041 $\frac{2}{3}$ foot Answer.
|— ··· |—

100

40

16

Whence it appears, That as the Product of the 1st and 2d Numbers is to the 3d: so is the Product of the 4th and 5th to the 6th

Number. Which also serves to prove the Rule;

For as 24000. 500 :: 98000. 2041 $\frac{2}{3}$.

And 24000 multiplied in 2041 $\frac{2}{3}$ is equal to 98000 multiplied by 500, viz. 49000000, as per Prop. 6. of Geom. Progression.

VI. *The second Variety of the Rule of Proportion by 5 Numbers.*

This is commonly called *the Rule by 5 Numbers Reverse*.

Example.] How many Men can dig $2041\frac{2}{3}$ feet in 10 Hours, at the rate of 1000 digging 500 foot in 24 Hours. *State your Question thus :*

<i>Men.</i>	<i>Hours.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Hours.</i>
1000 :	24 :	500.	$2041\frac{2}{3}$	10

i. e. If 1000 Men in 24 Hours dig a Trench of 500 Feet in length, how many Men can dig a Trench of $2041\frac{2}{3}$ foot long in 10 Hours?

To answer this, multiply the 1st, 2d, and 4th Numbers together for a Dividend, which divide by 5000, the Product of the 3d and 5th Numbers, and the Quotient is 9800 Men for Answer.

VII. *A Third Variety of the Rule of Proportion by 5 Numbers.*

This (altho omitted by Authors) is as likely to be used as the last: for (to put the same Question again, that the varying may the better appear)

If 1000 Men in 24 Hours can dig 500 foot of a Trench, (as mention'd under the 5th Head above;) in how many Hours can 9800 Men dig $2041\frac{2}{3}$ feet (of the like Trench?)

Rule.] Multiply the 1st, 2d, and 5th together, produceth 49000000 for a Dividend: Then multiply the 3d and 4th together for a Divisor, which is 4900000. So the Quote is 10 Hours, as in the two Cases above.

In the { 1st Case the Feet to be digged was sought, } $2041\frac{2}{3}$ Feet.
 { and found _____ }
 { 2d the Number of Men to dig the lar- } 9800 Men.
 { ger Trench in the lesser Time, and found }
 { 3d the Time in which the larger Num- } 10 Hours.
 { ber could dig the larger Trench, and found }

For Proof of the 2d Variety or Kind of Proportion by 5 Numbers: The Product made of the 1st, 2d, and 4th, is equal to that of the 3d, 5th, and 6th.

And for Proof of the 3d Variety: The Product under the 3d, 4th, and 6th, is equal to that of the 1st, 2d, and 5th.

VIII. Of Duplicate Proportion Direct.

This differs from the single Rule of Proportion Direct, in this :
 2 of the 3 (the 1st and 3d) requiring to be squared, when that
 sought (or the 4th Number) is not a Square, and 1, viz. the mid-
 dle or 2d Number, when that sought is a square Number, (or one
 whose Root must be extracted to give the specifick Answer.)

Or else it is when the Ratio is as the Square of one thing is to
 that of another, &c.

Examples.

The Diameter of a Circle being 2, the Area is $3\frac{1}{2}\frac{4}{10}\frac{1}{10}\frac{6}{10}$: therefore

What is the Area or
 superficial Content of a
 Circle, whose Diame-
 ter is 8 ?

<i>The Sqr. of the Diam.</i>	<i>The Area.</i>	<i>The Sqr. of the Diam.</i>	<i>The Area.</i>
4.	$3\frac{1}{2}\frac{4}{10}\frac{1}{10}\frac{6}{10}$	64.	$50\frac{2}{10}\frac{6}{10}\frac{5}{10}\frac{6}{10}$

*The Rule for stating
 the Question* is the same as for the single Rule Direct : And the Dia-
 meters being squared as you see (4 being the Square of 2, and 64
 of 8) *the Rule for performing the Operation* is the same as for single
 Direct Proportion ; for $3\frac{1}{2}\frac{4}{10}\frac{1}{10}\frac{6}{10}$ multiplied by 64, and that Product
 divided by 4, the Quotient is $50\frac{2}{10}\frac{6}{10}\frac{5}{10}\frac{6}{10}$ for Answer. For

Euclid has demonstrated, that Circles are in proportion as the
 Squares of their Diameters ; and accordingly, by this Proportion
 above we find the Area of a Circle $50\frac{2}{10}\frac{6}{10}\frac{5}{10}\frac{6}{10}$, whose Diameter is 8.

Example 2.] What is the Diameter of a Circle, whose Area is
 $50\frac{2}{10}\frac{6}{10}\frac{5}{10}\frac{6}{10}$? supposing the Diameter of a Circle, whose Area is
 $3\frac{1}{2}\frac{4}{10}\frac{1}{10}\frac{6}{10}$, be 2, (as it really is.)

This is stated as per
 Margin, and the Ope-
 ration done as be-
 fore. For

<i>The Area.</i>	<i>The Sqr. of the Diam.</i>	<i>The Area.</i>	<i>The Sqr. of the Diam.</i>
$3\frac{1}{2}\frac{4}{10}\frac{1}{10}\frac{6}{10}$.	4	$50\frac{2}{10}\frac{6}{10}\frac{5}{10}\frac{6}{10}$.	64

As $3\frac{1}{2}\frac{4}{10}\frac{1}{10}\frac{6}{10}$ (the Area of a Circle)

Is to 4 (the Square of that Circle's Diameter :)

So is $50\frac{2}{10}\frac{6}{10}\frac{5}{10}\frac{6}{10}$ (or the Area of any other Circle)

To (64) the Square of the Diameter of that Circle.

Now extract the Square Root of 64, and you have the Answer,
 viz. 8.

This and the last Example prove each other.

IX. Duplicate Proportion Reverse.

Example.] Admit the Pendulum of our common Clocks is 39 Inches, (as it is very little more) we know that such a Clock vibrateth Seconds, (or 60 times in a Minute.) Now what is the Length of a Pendulum that vibrateth Half-Seconds, (or 120 times in a Minute ?)

Questions under this Rule are most naturally stated as in single Reverse Proportion above ; and being so stated, must be so wrought after the Vibrations are squared.

By this State it appears that the Proportion is Reverse : for if 60 Vibrations

Vibrations.	Inches.	Vibrat.	Inches.
60.	39.	120.	$9\frac{3}{4}$

require a Pendulum 39 Inches long, it's plain that a Clock, whose Vibrations are 120 in a Minute, must have its Pendulum shorter, (for the longer the Pendulum, the fewer the Vibrations in a Minute; and the contrary :) therefore more requiring less, shews the greater Extreme (or 120) must be your Divisor, as appears by what is said under the first Example of single Reverse Proportion. So that multiplying the Square of $60 = 3600$ by 39, and dividing the Product by the Square of $120 = 14400$, the Quotient or Answer is $9\frac{3}{4}$ Inches.

Example 2.] A Pendulum of 39 Inches vibrating 60 times in a Minute ; how many times does that Pendulum vibrate in a Minute, whose Length is $9\frac{3}{4}$?

Here, by multiplying the two first towards the left hand together, viz. 39 and $3600 =$ (the

Inches.	The Sqr. of the Vibrat.	Inches.	The Sqr. of the Vibrat.
39.	3600.	$9\frac{3}{4}$	14400

Square of 60) and dividing the Product by $9\frac{3}{4}$ (as taught in Division of Vulgar Fractions) the Quotient is 14400, the Square of the Answer : therefore extract the Square Root of 14400, and you'll find it $120 =$ the Number of Vibrations in a Minute of a Pendulum whose Length is $9\frac{3}{4}$ Inches.

Example 3.] Admit a Body on the Surface of the Earth (or 4000 Miles distant from the Center thereof) weigh 20 Hundred weight, what will that Body weigh if it were 12000 miles above the Surface, or 16000 from the Center of it ? State your Question thus ;

Miles.	C.wt.	Miles.
4000	20	16000

Mul-

Multiply the Square of the 1st by the 2d, and divide the Product by the Square of the 3d, and the Quote is $1\frac{1}{4}$ C. Which shews, that a Ton weight, if 12000 miles high, will weigh but $1\frac{1}{4}$ C. and if 189314 miles high, 'twill weigh but a Pound, by the same Rule. So likewise the Velocity or Swiftneſs of Deſcent is alſo in proportion to a heavy Body's diſtance from the Center of the Earth in a duplicate Ratio: for the Celerity of the Fall on the Earth (or 4000 miles from the Center) being 16 foot in a Second; if the ſame Body be 16000 miles from the Center, it will fall but 1 foot in a Second, as you may eaſily prove by this preſent Rule, as aboveſaid.

I have given an Example under the ſingle Rule of Proportion Re- verſe, how theſe laſt, &c. may be performed as in Direct Proportion, by ſaying (in the 2d Example)

As $9\frac{3}{4}$. to 39 :: ſo 3600. to 14400, whoſe Root is 120.

But then this neither agrees, as to ſtating the Queſtion, with the Rules given for that purpoſe under the ſingle Rules Direct nor Re- verſe, and conſequently theſe Queſtions are moſt properly and na- turally to be performed as directed above, as agreeing with the Rules given for ſtating and working ſuch Queſtions.

X. Triplicate Proportion.

As in Duplicate Proportion the Ratio is as the Square of one Number is to another Number, or the contrary; ſo this kind, the Ratio is as one Number is to the Cube of another, or as the Cube of one Number is to ſome other Number.

Example 1.] If a Sphere (or Ball) which is 8 Inches Diameter, weigh 48 Pounds; what will another Sphere of the ſame Specie of Matter weigh, whoſe Diameter is 4 Inches?

This is a ſingle direct Pro- portion, (working with the Cubes of the Diameters) where the 4th Proportional is found lb 6. For

<i>The Cube of the Diam. 8.</i>	<i>lb its Weight.</i>	<i>The Cube of the Diam. 4.</i>
512.	48 ::	64.

As 512 = (the Cube of the Diameter 8.) is to 48 Pounds weight,
So is 64 (the Cube of the Diameter 4.) to 6 Pounds, the Weight required.

Example 2.] If a Sphere weighing 48 lb. be 8 Inches Diameter, what is the Diameter of another Sphere of the ſame Matter, whoſe Weight is 6 lb?

Here

Here by multiplying the 2d lb the The Cube of lb the
 and 3d Numbers together, and *Weight.* *the Diam.8.* *Weight.*
 dividing the Product by the 1st; 48. 512 :: 6.
 the 4th Proportional is 64, the
 Cube Root whereof is 4 = the Answer. For

As 48 Pounds weight is to 512 (the Cube of the Diameter 8)

So is 6 Pounds weight to 64 (the Cube of the Diameter sought)
 whose Root is 4.

And as the Weight, so the Solidity of Spheres is found by the
 same Ratio.

Example 3.] Ad-
 mit the solid Con-
 tent of a Sphere
 be $4\frac{1}{3}\frac{8}{1000}$, whose

The Cube of
the Diam. 2.
 8.

The Soli-
dity.
 $4\frac{1}{3}\frac{8}{1000} ::$

The Cube of
the Diam. 4.
 64.

The Soli-
dity.
 $33\frac{5}{3}\frac{104}{1000}$

Diameter is 2; what is the Solidity of another Sphere, whose Dia-
 meter is 4?

Here you see that As the Cube of the Diameter 2, viz. 8.

Is to the Solidity of that Sphere $4\frac{1}{3}\frac{8}{1000} :$

So is the Cube of the Diameter 4, viz. 64.

To the solid Content of that Sphere, viz.
 $33\frac{5}{3}\frac{104}{1000}$.

Example 4.] The Diameter of a Sphere being 2, whose Solidity is
 $4\frac{1}{3}\frac{8}{1000}$; what is the Diameter of another Sphere, whose Solidity
 is $33\frac{5}{3}\frac{104}{1000}$? Answ. 4; the Cube Root of 64: for as $4\frac{1}{3}\frac{8}{1000} : 8 ::$
 $33\frac{5}{3}\frac{104}{1000} : 64$.

XI. Harmonical Proportion.

In this kind of Proportion there are 3 Numbers given to find a
 4th, which shall bear such direct Proportion to the first, as the Dif-
 ference between the 3d and 4th bears to the Difference between the
 1st and 2d.

It is called Harmonical (or Musical Proportion) probably by
 reason of the double Ratio of the Numbers among themselves.

The Rule to find the 4th Proportional, is, Multiply the 1st and
 3d together, and divide the Product by double the 1st, less the 2d;
 and the Quotient is the 4th Number required.

Example.] What is the 4th Proportional Harmonical to these 3
 Numbers 7 : 10 : 12? Answ. 21.

See the Work in the Margin.

For Proof of this, as abovesaid :

$$21. 7 :: 9. 3$$

That is, as 21, the 4th Number (or that required in the Question) is to 7 (the 1st Number) so is the Difference between 12 and 21, viz. 9. to the Difference between the 1st and 2d, or 7 and 10, viz. 3.

Hence as a Corollary it will appear, That double the 1st Number must exceed the 2d Number, otherways you'll want a Divisor, and cannot find the requisite Number without the Arithmetic of Negatives.

$$\begin{array}{r} 7 : 10 : 12 : 21 \\ \hline 2 \qquad \qquad 7 \end{array}$$

$$\begin{array}{r} \text{Product } 14 \\ \text{Lefs } 10 \\ \hline \text{Rests } 4 \end{array} = 4) 84 (21$$

XII. Sesquiplicate Proportion.

In this kind of Ratio the Square of one Number is in proportion to the Cube of another, and the contrary.

It is used in finding the Distance of the Planets in the Solar System from the Sun their Center, about which they revolve : For As the Square of the Time in which any Planet finisheth its Periodical Revolution,

Is to the Cube of its Distance from the Sun ::

So is the Square of any other Planet's Time

To the Cube of its Distance. Thus

	Days.		Miles.
The Earth finishes its	} 365 $\frac{1}{4}$	And its Distance	} 86000000
Period in		from the Sun is	
Mars	625	about	130000000
Jupiter	4333		440000000
&c.			

SECT. IV. Rules of Practice.

THIS is a briefer Method of casting up any Quantity of Merchandize than the Rule (commonly used) of Proportion or Multiplication. And 'tis done by considering what even Parts of a Pound the given Price is, or is reducible to, and then framing a Rule accordingly.

It is called the Rule of Practice because of its excellent Use in the Practice of Merchandize, for dispatching many Computations with much ease and in a short time.

I shall not trouble the Reader with shewing him a Table of the even Parts of a Shilling or a Pound, by reason I have given an intire Table, with the Fabrick thereof, at the end of Division, and have reduced the whole Business of Practice into Rules arising gradually in the Value of the Integer in so regular and copious a Method, that any one may easily find his Rate or Value of the Yard, Ell, Pound, Ounce, &c. and right against it a Rule how to perform the Operation after the best and most concise manner. And he will generally know which are the even Parts of a Pound by the Shortness of the Rule, being only one Division required to bring the given Number into Pounds respectively. I have mark'd the Aliquot Parts of a Pound with *A. P. L.* in the Table: And I think I may affirm, that this most copious, regular, and short Way of Practice, was first (and only) shewn by myself, where I take no notice of the Parts of a Shilling, but of a Pound only.

The main thing that makes the Rules of Practice preferable, is the performing the Operation mentally, without putting down any Figures but the Quotients or Answers for the most part: And this is done by chusing proper Divisors, few or none of which exceed 12; to which Number inclusive my Multiplication-Table foregoing extends, and is supposed to be perfectly in the Reader's memory.

But before I proceed to the Tables, it will be necessary to give these previous Cases.

Case 1.] When the Value of the Integer is 2s. you have the Answer by only cutting off the Units place (or dividing by 10), 2s. being the 10th part of a Pound; and the Figure in Units place is so many two Shillings. Thus 34765 Ells at 2s. each is $l. 3476 : 10$; those to the left hand Units place being so many Pounds. So also 9734 at 2s. is $l. 973 : 8 : -$; and 875 is $l. 87 : 10 : -$

Case 2.] From the last Case it will follow, that if the Price is any even Number of Shillings for the Unit; the whole Parcel will be half so many Shillings as the Value of the Unit is, multiplied in what such Parcel would amount to at 2s. Thus 7876 at 18s. is $l. 7876$ at 2s. therefore it is 9 times that at 18s. So multiply 7876 by 9 thus,

9 times

9 times 6 (cut off) is 54 two Shillings, put down 8s. and carry 1.5; then 9 times 7l. is 63, and 5 carried is 68; and so proceed to multiply the 78, and you'll find the Answer to be £ 7088 : 8 : — And by the same Rule 19468 at 16s. is £ 15574 : 8 : — I say 8 times 8 is 64, twice the 4 is 8s. and carry 1.6, &c. Likewise 97357 at 14. is £ 68149 : 18 : — &c.

Case 3.] When the Value of the Integer or Unit is 1s. what is the Value of 135694?

135694
|

You must take a 20th part, cutting off Units place, and taking half what rests to the left hand, as half 13 is 6, $\frac{1}{2}$ of 15 is 7, $\frac{1}{2}$ of 16 is 8, and $\frac{1}{2}$ of 9 is 4, and the 10s. remaining, and the 4 cut off is 14s. because the Value at 1s. per Unit is half as much as at 2s.

Answer £ 6784 : 14 : —

Case 4.] When the Price of the Unit is 6d. take a 40th of the given Number, which suppose 17372, cut off the 2 from 17372, and take a 4th of the rest: So the Answer at one Work is £ 434 : 6s. for 12 Sixpences remains. For 4 in 17 is 4, 4 in 13 is 3, and 4 in 17 is 4, the 434l.

Case 5.] When the Price of the Unit is 4d. and you are directed to take a 60th part of the given Number, which suppose

5567
|

Here the Units place being cut off, I take a 6th of what is to the left hand the dash, thus 6 in 55 is 9, and rests 1; 6 in 16 is 2, and there rests 4, which with the 7 is 47 Groats, or 15s. 8d. the Answer.

$\frac{1}{6}$ is £ 92 : 15 : 8

Case 6.] When the Value of the Unit is 3d. and you are directed in the subsequent Rules to take $\frac{1}{3}$ of the given Number, which suppose 7539; cut off the Units place, and take $\frac{1}{3}$ of the remaining Figures, as 8 in 75 is 9, 8 in 33 is 4, and 19 Three-pences (or 4s. 9d.) over.

7539
|

Case 7.] When the Price of the Unit is 2d. and you are directed to take $\frac{1}{2}$ of the given Number, which suppose 19739; cut off the 9 in Units place, and take $\frac{1}{2}$ of the rest: so 12 in 19 is 1, 12 in 77 is 6, 12 in 53 is 4, and 59 Two-pences rests, or 9s. 10d. And that the Remainders in these

$\frac{1}{2}$ is £ 94 : 4 : 9

19739
|

$\frac{1}{2}$ = £ 164 : 9 : 10

four last Cases may not, when large, seem difficult to cast up, I shall subjoin *this little Table of Remainders* in Shillings and Pence.

Remainers.	Two-pences.	Three-pences.	Four-pences.	Six-pences.
10	1 s. 8 d.	2 s. 6 d.	3 s. 4 d.	5 s. 0 d.
20	3 4	5 0	6 8	10 0
30	5 0	7 6	10 0	15 0
40	6 8	10 0	13 4	
50	8 4	12 6	16 8	
60	10 0	15 0		
70	11 8	17 6		
80	13 4			
90	15 0			
100	16 8			
110	18 4			

Thus by this Table the 47 Groats which remained in the 5th Case above, is 15 s. 8 d. for 40 under Four-pences is 13 s. 4 d. and 7 Groats (or 2 s. 4 d.) is 15 s. 8 d.

Note 1. That the Remainders are of the same Denomination with the Dividends: As in the Example to the 5th Rule I suppose in the first Operation the Dividend Two-pences, and therefore dividing by 120; I find 47 Two-pences remaining, or 7 s. 10 d. And what remains after in taking any part of the Quotients, are Pounds, Shillings, or Pence, as those Quotients are. The Cases above, and the Rules and Examples following, make this very evident.

The Value of the Pound, Ell, Yard, &c. s. d. qr. Here followeth 149 Rules (with Examples for such as seem the most difficult) for the brief working by Practice to give the Answer in Pounds, &c. the like not extant, by any other Hand. *Number of Rules.*

A. P. L.	1	Take $\frac{1}{8}$ of $\frac{1}{12}$ of the given Number (or $\frac{1}{96}$ thereof)	1
A. P. L.	2	Take an 80th of a 6th of the given Number	2
A. P. L.	3	Take $\frac{1}{8}$ of $\frac{1}{4}$ of the given Number (or $\frac{1}{32}$ thereof)	3
A. P. L.	—:1:—	Take a 20th of a 12th of the given Number, or take an 120th and deduct $\frac{1}{2}$ thereof	4
A. P. L.	1:1	To $\frac{1}{2}$ of 120th of the given Numb. add a 4th of that $\frac{1}{2}$	5
A. P. L.	1:2	Take a 20th of an 8th of the given Number, or $\frac{1}{160}$	6
	1:3	From 120th of the given Number take an 8th of that 120th	7
A. P. L.	2:—	Take an 120th of the given Number	8
	2:1	To an 120th of the given Number add an 8th, of that 120th	9
A. P. L.	2:2	To an 120th of the given Number add $\frac{1}{4}$ of that 120th, or take $\frac{1}{30}$	10
	2:3	From an 80th of the given Number take a 12th of that 80th	11
A. P. L.	3:0	Take an 80th of the given Number, as per Case 6.	12
	3:1	To an 80th of the given Number add a 12th of that 80	13
	3:2	To an 80th of the given Number add a 6th of that 80	14
A. P. L.	3:3	To an 80th of the given Number add a 4th of that 80th, (or take a 64th)	15
A. P. L.	4:—	Take a 60th of the given Number, as per prev. Case 5.	16
	4:1	To an 120th of the given Number twice put down, add an 8th of 120th	17
	4:2	To a 60th of the given Number add an 8th of that 60	18
	4:3	To a 60th of the given Number add an 8th of that 60th, and $\frac{1}{2}$ that 8th	19
A. P. L.	5:—	Take an 8th of a 6th of the given Numb. or take $\frac{1}{48}$	20
	5:1	From a 40th of the given Numb. take an 8th of that 40	21
	5:2	From a 40th of the given Number take a 12th of that 40th	22
	5:3	From an 80th of the given Number twice put down, take a 12th of an 80th	23
A. P. L.	6:—	Take a 40th of the given Numb. as per previous Case 4.	24

Example to Rule 5.

19727 at 1 d. 1 q.

$\frac{1}{120} = l. 164: 7: 10$
 $\frac{1}{2}$ of that $l. 82: 3: 11$
 $\frac{1}{4}$ of that $\frac{1}{2} l. 20: 10: 11 \frac{3}{4}$ } ad
 Sum, $l. 102: 14: 10 \frac{3}{4}$
 the Answer.

Example to Rule 17.

9376 at 4 d. 1 qr.

$\frac{1}{120} = l. 78: 2: 8$
 ditto $l. 78: 2: 8$ } ad
 $\frac{1}{8}$ of $\frac{1}{120} l. 9: 15: 4$
 Sum, $166: —: 8$ Ans.

Example to Rule 23.

8935 at 5 d. 3 qr.

$\frac{5}{8} l. 111: 13: 9$
 ditto $111: 13: 9$
 Sum, $l. 223: 7: 6$
 $\frac{1}{12}$ of $\frac{5}{8} = 9: 6: 1 \frac{3}{4}$ ded.
 Rests = $214: 1: 4 \frac{1}{4}$ Ans.

The Value
of the
Pound, Ell,
Yard, &c.
d. gr.

The Continuation of the Table of Rules for the
Short Work of Practice, &c. as before.

Number
of
Rules.

6 : 1	To an 80th of the given Number twice put down, } add a 12th of an 80th. _____	25
6 : 2	To a 40th of the given Numb. add a 12th of that 40th. _____	26
6 : 3	To a 40th of the given Numb. add an 8th of that 40th. _____	27
7 : 0	To a 40th of the given Numb. add a 6th of that 40th. _____	28
7 : 1	To a 40th of the given Number, add a 6th of that } 40th, and a 4th of that 6th. _____	29
A. P. L. 7 : 2	To a 40th of the given Number add a 4th of that } 40th, (or take $\frac{1}{5}$ of the given Number) _____	30
7 : 3	To a 40th of the given Number add a 4th of that } 40th, and a 6th of that 4th. _____	31
A. P. L. 8 : —	Take a 30th of the given Number. _____	32
8 : 1	From an 80th of the given Number put down 3 } times, take the 4th of an 80th. _____	33
8 : 2	To a 60th of the given Number put down twice, } add an 8th of a 60th. _____	34
8 : 3	From an 80th of the given Number thrice put } down, take a 12th of an 80th. _____	35
9 : —	To a 40th of the given Number add half of that 40th. _____	36
9 : 1	To an 8th of the given Number thrice put down, } add a 12th of an 80th. _____	37
9 : 2	To an 80th of the given Number thrice put down, } add a 6th of an 80th. _____	38
9 : 3	To an 80th of the given Number thrice put down, } add a 4th of an 80th. _____	39
A. P. L. 10 : —	Take an 8th of a 3d of the given Number, (or a } 24th part.) _____	40
10 : 1	To a 30th of the given Number add a 4th of that } 30, and an 8th of that 4th. _____	41
10 : 2	From a 20th of the given Numb. take an 8th of that 20. _____	42
10 : 3	To a 40th and a 60th of the given Number, add an } 8th of that 40th. _____	43
11 : —	From a 20th of the given Numb. take a 12th of the 20. _____	44
11 : 1	From a 40th of the given Number twice put down, } take an 8th of a 40th. _____	45
11 : 2	From a 40th of the given Number twice put down, } take a 12th of a 40th. _____	46
11 : 3	To a 30th of the given Number add an 80th, and } a 4th of that 80th. _____	47

Example to Rule 31.

7238 at 7d. 3 gr.

Example to Rule 35.

3929 at 9d. 1q.

Example to Rule 45.

1895 at 11d. 1q.

$\frac{1}{2} = l. 180 : 19 : -$
 $\frac{1}{4}$ of the 40th $l. 45 : 4 : 9$
 $\frac{1}{2}$ of the 4th $l. 7 : 1q : 9\frac{1}{2}$
 Answer, $l. 233 : 14 : 6\frac{1}{2}$

an 80th $= l. 49 : 2 : 3$
 ditto $= 49 : 2 : 3$
 ditto $= 49 : 2 : 3$
 $\frac{1}{12}$ of $\frac{1}{2} = 4 : 1 : 10\frac{1}{4}$
 Sum, Answ. $151 : 8 : 7\frac{1}{4}$

a 40th $= l. 47 : 7 : 6$
 ditto $= 47 : 7 : 6$
 $l. 94 : 15 : -$ Sur
 $\frac{1}{8}$ of $\frac{1}{4} = 5 : 18 : 5\frac{1}{4}$ Dec
 Rests $l. 88 : 16 : 6\frac{3}{4}$ An

Value of the
Pound, Ell,
Yard, &c.
s. d. qr.

*A Continuation of the Table of Rules for the
Short Work of Practice.*

Number
of
Rules.

<i>A. P. L.</i> 1 : 0 : 0	Take a 20th of the given Numb. (as per prev. Case 3.)	48
1 : - : 1	To a 40th of the given Number, and a half of that 40th twice put down, add a 12th of one of the $\frac{1}{2}$.	49
1 : - : 2	To a 40th of the given Number twice put down, add a 12th of a 40th.	50
1 : - : 3	To a 40th of the given Number twice put down, add an 8th of a 40th.	51
1 : 1 : -	To a 20th of the given Numb. add a 12th of that 20th.	52
1 : 1 : 1	To a 20th of the given Number add a 12th of that 20th, and a 4th of the 12th.	53
1 : 1 : 2	To a 20th of the given Numb. add an 8th of that 20th.	54
1 : 1 : 3	To a 20th of the given Number add an 8th of that 20th, and a 6th of the 8th.	55
1 : 2 : -	To a 20th of the given Numb. add a 6th of that 20th.	56
1 : 2 : 1	To a 20th of the given Number add a 6th of that 20th, and an 8th of that 6th.	57
1 : 2 : 2	To a 20th of the given Number add a 6th of that 20th, and a 4th of that 6th.	58
1 : 2 : 3	To a 30th of the given Number add a 40th of it, and an 8th of the 40th.	59
<i>A. P. L.</i> 1 : 3 : -	Take half of an 8th of the given Numb. (or a 16th)	60
1 : 3 : 1	To a 20th of the given Number add a 4th of the 20th, and a 12th of the 4th.	61
1 : 3 : 2	To a 20th of the given Number add a 4th of that 20th, and a 6th of the 4th.	62
1 : 3 : 3	To a 20th of the given Number add a 4th of that 20th, and a 4th of that 4th.	63
<i>A. P. L.</i> 1 : 4 : -	Take a 30th of the given Number, and double it (or put down twice) or take a 15th of the given N ^o	64
1 : 4 : 1	To $\frac{1}{2}$ of an 8th of the given Numb. add a 12th of that $\frac{1}{2}$.	65
1 : 4 : 2	To a 20th of the given Number add a 3d of that 20th, and an 8th of the 3d.	66
1 : 4 : 3	To a 40th of the given Number twice put down, add a 60 of the given Numb. and an 8th of a 40th.	67
1 : 5 : -	From a 12th take an 8th of the given Number.	68
1 : 5 : 1	From a 20th of the given Number added to $\frac{1}{2}$ the 20th, take an 8th of that half.	69
1 : 5 : 2	From a 20th of the given Number added to half that 20, take a 12th of that half.	70
1 : 5 : 3	From a 20th of the given Number added to a 4th of that 20th twice put down, take a 12th of said 4th.	71

Example to Rule 65.

893 at 16 d. $\frac{1}{4}$

an 8th = l. 111 : 12 : 6

$\frac{1}{2}$ an 8th, l. 55 : 16 : 3

$\frac{1}{2}$ of the $\frac{1}{2}$ = 4 : 13 : 0 $\frac{1}{4}$

Answer, l. 60 : 9 : 3 $\frac{1}{4}$

Example to Rule 67.

1239 at 16 d. $\frac{3}{4}$

a 40th l. 30 : 19 : 6

ditto 30 : 19 : 6

a 60th = 20 : 13 : -

$\frac{1}{4}$ of a 40th 3 : 17 : 5 $\frac{1}{4}$

Sum, l. 86 : 9 : 5 $\frac{1}{4}$

Example to Rule 71.

952 at 17 d. $\frac{3}{4}$

a 20th l. 47 : 12 : -

$\frac{1}{4}$ of a 20, l. 11 : 18 : -

ditto l. 11 : 18 : -

Sum, 71 : 8 : -

a 12 of a 4 = 19 : 10 ded.

Refts l. 70 : 8 : 2 Answ

The Value
of the
Pound, Ell,
Yard, &c.

A Continuation of the Table of Rules for the
Short Work of Practice.

Number
of
Rules.

	s.	d.			
	1	6	To a 20th add half that 20th		72
	1	7	From a 12th of the given Number take a 20th of that 12th		73
A. P. L.	1	8	Take a 12th of the given Number		74
	1	9	To a 12th of the given Numb. add a 20th of that 12th		75
	1	10	To a 12th of the given Number add a 10th of that 12th		76
	1	11	Add an 80th to a 12th of the given Number		77
A. P. L.	2	—	Take a 10th of the given Number, as per previous Case 1.		78
	2	1	To a 12th of the given Number add a 4th of that 12th		79
	2	2	To a 10th of the given Numb. add a 12th of that 10th		80
	2	3	To a 10th of the given Number add an 8th of that 10th		81
	2	4	To a 10th of the given Number add a 6th of that 10th		82
	2	5	To a 12th of the given Number add a 4th of that 12th		83
A. P. L.	2	6	Take an 8th of the given Number		84
	2	8	To a 10th of the given Number add a 3d of that 10th		85
	2	9	To an 8th of the given Number add a 10th of that 8th		86
	3	0	To a 10th of the given Number, add half that 10th.		87
	3	3	From a 6th of the given Number take a 40th of that 6th		88
A. P. L.	3	4	Take a 6th of the given Number		89
	3	6	To a 6th of the given Number add a 20th of that 6th		90
	3	8	To a 6th of the given Number add a 10th of that 6th		91
	3	9	To a 6th of the given Number add an 8th of that 6th		92
A. P. L.	4	0	Take a 5th of the given Number, (or shorter) take 2 Tenths of the given Number		93
	4	3	To a 10th of the given Number twice put down, add an 8th of a 10th		94
	4	4	To a 10th twice put down, add a 6th of a 10th		95

Example to Rule 73.	Example to Rule 88.	Example to Rule 94.
1047 at 1s. 7 d.	895 at 3s. 3 d.	739 at 4s. 3 d.
a 12th = l. 87: 5: —	a 6th = l. 149: 3: 4	a 10th = l. 73: 18: —
a 20 of a 12, 4: 7: 3	a 40th of $\frac{1}{4}$ l. 3: 14: 7 ded.	ditto l. 73: 18: — } Ad.
Resteth l. 82: 17: 9	Resteth l. 145: 8: 9	$\frac{1}{4}$ of a 10th, 9: 4: 9
the Answer.	the Answer.	Sum = 157: —: 9 Answ.

The Value
of the
Pound, Ell,
Yard, &c.

A Continuation of Rules for the short Work
of Practice.

Number
of
Rules.

	s. d.		
	4 : 6	To a 10th add an 8th of the given Number	96
	4 : 8	To a 10th of the given Number twice put down, add a 3d of a 10th	97
	4 : 9	From a 4th of the given Number take a 20th of that 4th	98
A. P. L.	5 : 0	Take a 4th of the given Number	99
	5 : 6	To a 4th of the given Number add a 10th of that 4th	100
	6 : —	Take 3 Tenths of the given Number, as per pre- vious Case 2.	101
A. P. L.	6 : 8	Take a 3d of the given Number	102
	7 : —	Work for 6 s. and 1 s. as per previous Cases 2, & 3.	103
	7 : 6	Take an 8th of the given Number, and put it down thrice, or multiply by 3.	104
	8 : —	Take 4 Tenths of the given Number, as per previous Case 2.	105
	8 : 6	To 4 Tenths add a 40th of the given Number	106
	9 : —	To 4 Tenths of the given Number add a 20th thereof	107
	9 : 6	From half the given Number take a 20th of that half	108
A. P. L.	10 : 0	Take half the given Number	109
	10 : 6	To half the given Number add a 20th of that half	110
	11 : —	To half the given Number add a 10th of that half	111
	11 : 6	From 6 Tenths take a 40th of the given Number	112
	12 : —	Take 6 Tenths of the given Number, as per pre- vious Case 2.	113
	12 : 6	To half the given Number add a 4th of that half	114
	13 : —	Take 6 Tenths of the given Number, and add to a 20th thereof	115
	13 : 4	To half add a 6th of the given Number	116
	14 : —	Take 7 Tenths of the given Number, as per pre- vious Case 2.	117
	14 : 6	To 7 Tenths add a 40th of the given Number	118
	15 : —	To $\frac{1}{2}$ the given Number add half of that half, (or from the given Number take $\frac{1}{4}$)	119

Example to Rule 104.

559 at 7 s. 6 d.

an 8th = 1.69:17:6
Multiply by 3
Prod. = 1.209:12:6
or Answer.

Example to Rule 112.

365 at 11 s. 6 d.

6, 10ths = 219: as p. Cas. 2.
a 40th = 1.9: 2:6 ded.
Refts = 1.209:17:6 Ans.

Example to Rule 115.

169 at 13 s.

6 tenths 101: 8:—
a 20th = 1.8: 9:—
Sum, 1. 109:17:— Ans.

Note, That A. P. L. signifies the Aliquot Parts of a Pound.

The Value
of the
Pound, Ell,
Yard, &c.

A Continuation of Rules for the short Work of
Practice.

Number
of
Rules.

s. d.			
15:6	From 8 Tenths (as per previous Case 2) take a 40th of the } given Number		120
16:-	Take 8 Tenths of the given Number		121
16:6	To 8 Tenths add a 40th of the given Number		122
17:-	To 8 Tenths add a 20th of the given Number		123
17:6	From the given Number take an 8th thereof		124
18:-	Take 9 Tenths of the given Number		125
18:6	To 9 Tenths add a 40th of the given Number		126
19:-	From the given Number take a 20th thereof		127
19:6	From the given Number take a 40th thereof		128

Note, That where Pounds, Shillings, &c. are the Price of a Unit; you must multiply the Units given by the Pounds; and work for the Shillings, &c. as before directed. See the 2d Case of the next Section.

per Cent. or 100. The following shew how Interest, Commission to Factors, Customs, &c. is cast up by the short Rules of Practice.

1 per C.	Take the 100th part of the given Number, (as per Rule 3. } Prop. 3. in Division.)		129
2	Take a 50th of the given Number		130
2 $\frac{1}{2}$	Take a 40th of the given Number		131
3	To a 50th of the given Number add half that 50th		132
4	Put down a 50th of the given Number twice		133
4 $\frac{1}{2}$	To a 50th add a 40th of the given Number		134
5	Take a 20th of the given Number		135
6	Take a 50th of the given Number, and put it down thrice } (or multiply it by 3.)		136
7	Add a 20th to a 50th of the given Number		137
8	Multiply a 50th of the given Number by 4		138
9	From a 10th of the given Number take a 10th of the 10th		139
10 per Cent.	Take a 10th of the given Number		140

Eight Examples to the Rules for finding Interest, &c. by Practice; viz.

What is l. 1541:16:3 at 1 per C.	What l. 2132:12:6 $\frac{1}{2}$ at 2 $\frac{1}{2}$ p. C.	What 3235:17:11 $\frac{3}{4}$ at 5 per C.
100 part is l. 13:8:4 $\frac{1}{4}$ Answ.	a 40th is l. 53:6:3 $\frac{3}{4}$ Answer.	a 20th is l. 161:15:10 $\frac{3}{4}$ Answ.
What is l. 879:10:7 at 6 per C.	What l. 933:8:10 at 7 per C.	What 671:—:2 $\frac{1}{4}$ at 8 per C.
a 50th = l. 17:11:9 $\frac{3}{4}$	a 20th l. 46:13:5 $\frac{1}{4}$	a 50th l. 13:8:4:3 $\frac{1}{4}$
Multiply by .....3	a 50th l. 18:13:4 $\frac{1}{2}$	which multiply by ..4
Produceth 52:15:5 $\frac{1}{4}$ Answ.	Sum, l. 65:6:9 $\frac{3}{4}$ Answ.	Prod. l. 53:13:7 $\frac{1}{4}$ Answer.
What is l. 472:14:5 $\frac{1}{2}$ at 9 per Cent.	What l. 1976:19:11 $\frac{1}{4}$ at 10 per Cent.	
a 10th is = l. 47:5:5 $\frac{1}{4}$	a 10th is l. 197:13:10 $\frac{3}{4}$ Answer.	
a 10th of that 10. l. 4:14:6 $\frac{1}{2}$ dedu&.		
Refteth = l. 42:10:10 $\frac{3}{4}$ the Answer.		

See more of computing Interest, in the Use of Decimals, Chap. 3.

I shall next very briefly shew the Use of Rules of Practice in making Allowance for Tare; which is an Allowance for the Bag, or whatsoever a Commodity is pack'd up in, for some things more, some less. The Weight of the Goods, and what contains them, is together called the Gross Weight, and the Weight of the Goods alone is the Nett Weight.

<i>Goods.</i>	<i>Allowance per the 112 lb.</i>	<i>N^o of Rules.</i>	<i>Rules for the short Working.</i>
Curran	lb 16	141	Take a 7th of the gross Weight.
Almonds, Steel, Hemp	14	142	Take an 8th of the gross Wt.
Allum, Salt-petre, Tallow,	12	143	From an 8th take a 7th of that 8th.
Brimstone, Copperas, Cop- per,	8	144	Take half of a 7th of the gross Weight.
Iron Wire, Lattin Wire	6	145	Take half of what it comes to at 12, as above.
Cotton - Wool, Lambs- Wool, and Polish-Wool, Feathers, Hops	4	146	Take a 4th of a 7th of the gross Weight.
Cotton-Yarn 5 lb at 100 weight.		147	Take a 20th, or half a 10th of the gross Weight.
		148	A General Rule (especially for such Rates of Tare as are most remote from being Aliquot Parts of 112 lb; such as 3, 5, 9, 11, &c.) is this.

Example to Rule 143.

C. qr. lb.

Gross 29 : 3 : 24 at 12 per C.

$\frac{1}{8}$ is . . 3 : 2 : 27 $\frac{1}{2}$

a 7th of that 8, 0 : 2 : 3 $\frac{3}{4}$ ded. from the 8th.

Resteth Tare 3 : — : 23 $\frac{3}{4}$ = Answ.
or the

Nett Weight 26 : 3 : — $\frac{1}{4}$; the Gross,
less the Tare.

Multiply the gross Hundreds by the Pounds to be allowed for 1 C. and for the Quarters of Hundreds and Pounds take a Part proportionable of the Allowance per Hundred, and the Sum is an easy way of giving the Answer.

Example to Rule 145.

C. qr. lb.

Gross 37 : 2 : 12 at 12 lb per C.

$\frac{7}{8}$ is 4 : 2 : 22

a 7th of that 8, — : 2 : 19 deduct from the 8th.

Rests = 4 : — : 3 = the Tare at 12 per C.

$\frac{1}{2}$ of that is 2 : — : 1 $\frac{1}{2}$ the Tare at 6 per C. = Ans.

And if ded. } there rests } 35 : 2 : 10 $\frac{1}{2}$ Nett Weight

The Example to Rule 143. done according to this General Rule 148.

Multip. { 29 : 3 : 24 at 12 per C. or 112 lb.

Prod. = 348 lb. } for the 3 q. 9 the lb 24, 2 $\frac{3}{4}$

lb 359 $\frac{1}{4}$ Sum, or 3 C. — qr. 23 $\frac{3}{4}$ lb. as before.

For Oil imported there is allowed 18 per Cent. (or 112 lb.) Tare : Now suppose I import 180 Hund. wt. how many Nett Tons and Gallons is there ?

The Proof, viz.

C.	q.	lb.
180 :	0 :	0 Gross.
<hr/>		
Ton 9 :	00 :	Gall.
Deduct	12	
<hr/>		
Ton } 8 :	240 :	Gal. Ans.
Nett }		

Multiply { 180 Hundr. Gross.
94 lb per Nett Hundr.

72
162

Gall.

lb per Gal. = 7 $\frac{1}{2}$) 16920 lb. (2256 (8 Ton.
252)

240 Gal. rest.

Rule 149.] Take a 20th of the Gross Hundreds, (is here 9 Ton.) For every Ton deduct 1 $\frac{1}{2}$ Gallon ; so 9 and $\frac{1}{2}$ of 9 is 12, and the Remainder is the Answer, as is proved above.

Now 18 per Cent. is 12 $\frac{1}{2}$ Gallon per Nett C. therefore what Hundreds are in Units place must be multiplied by 12 $\frac{1}{2}$; and for the Quarters of C. and Pounds, take a proportionable part of 12 $\frac{1}{2}$: from the Sum of all which take the 1 $\frac{1}{2}$ Gallon per Ton.

Another Example makes this plain ; which I am minded to do, because it has not been before.

What Nett Tons and Gallons are in 189 C. 3 q. 21 lb. Gross ? See the Operation.

And

And for Proof of this Work by the longer way, do thus :

C. 189 : 3 : 21

Ton. Gall.

9 : 112½ for the 189 C. }
 9¾ for 3 qrs. } Gros.
 2½ for the 21 lb. }

9 : 124 Sum, Gros.
 12 = 9 & ⅓ of 9 deduct.

9 : 112 rest Nett Answer.

C. 189 : 3 : 21

lb in a Nett C. 94 multiply

756

1701

17766 lb in 189 C.
 88 lb ad.

And in 3 qrs.
 21 l. or 105 l.
 gros, there
 are Nett 88 l.
 thus

lb 7½ per) 17854 Sum.
 Gall.

Gall. 112.94 :: 105.88.

252) 2380 (9 Ton
 Ans.

and 112 lb rest,
 as in the shorter way.

The Reason of the short Rule.

There are two things that seem to some as Difficultys in the shorter Way, viz.

1. Why the Hundreds in Units place, the Quarters and Pounds, are cast up at the Rate of 12½ per Cent.

2. Why 1½ is deducted for every Ton.

As to the 1st, you see in the Margin that in a Nett Hundred there are 12½ Gallons, and somewhat more. And

As to the 2d, you may observe from the Work in the Example above, that the Units place of C. the Quarters and Pounds given, are work'd

according to the Nett Measure of 12½ Gall. per Nett C. But in taking a 20th of the Hundreds Gros, (or half the Figures to the left hand the Units place of Hundreds) that half makes more than Nett Tons by 1½ Gallon in every Ton, as per Margin above; and that is the reason you deduct 1½ in each Ton.

112 = the Gros C.
 deduct 18 per C. the Tare.

lb 94 = the Nett C.
 lb 7½) (12½ Gal. per C.
 Multiply by = 20 = the

Hund. in a Ton, and it gives 250½, which
 Taken from the Ton gros 252, there

Remains 1½ Gallon.

Note that Tret is an Allowance in Merchandize of $\frac{1}{4}$ at 104 for the Dust or Refuse of the Commodity; and this is deducted out of the Suttle, (which is the Remainder when the Tare is deducted.)

SECT. V. Concerning Gain and Loss.

THIS is a Rule whereby Merchants or other Traders know (when they have bought any Commodity by wholesale) how they may retail the same out, to make any certain Gain by the whole Parcel, or at any Rate *per Cent.* &c.

Or when any Goods are damaged, they know hereby what they shall lose *per Cent.* or by the whole, in selling the Pound, Ell, Yard, Ounce, &c. at any Rate less than it cost.

I shall place this and the following Sections relating to the Business of Trade, &c. in that Order which I judge most proper for them to be learnt; not regarding what Method others have observed in treating thereof.

Case 1.] When a Merchant buyeth Goods for a certain Sum, to find how the same may be retail'd to gain a required Sum by the whole.

Examp. A Merchant buys $\text{£}3780$ Nett of Cotton-Wool, for 126l . what may he sell the same for *per lb.* to gain 15s : 15d : by the Sale?

Rule. Add 15s : 15d : — to the Cost, and the Sum is 141l : 15s : —. Then say, If $\text{£}3780$ cost me 141l : 15s : —, what will 1 lb cost? Divide the Pence in 141l : 15s : by 3780 , and the Quotient is 9d which it must be sold for *per Pound*, to gain 15s : 15d : in all.

Case 2.] Admit I bought 15 Bales of Linen at 17l : 15s : *per Bale*, how much must I sell it for *per Bale*, to gain 10 *per Cent.* by the Sale?

Add $\text{£}266 : 5 : -$ Bales 15 at 17l : 15s : each.
 $\text{£}26 : 12 : 6$

The Value of the
 Linen, and 10 *per*
Cent. ————— } $1292 : 17 : 6$

$\frac{17}{105}$
 $\frac{15}{15}$
 1255 at 17l .
 $7 : 10$ at 10 .
 $3 : 15$ at 5 .

You see, by Practice, the Value of the Bales is $1266 : 5 : -$

Then as 100 to $10 : : 1266 : 5$ to $126 : 12 : 6$; which is the Advance at 10 *per Cent.* which added as above, makes $1292 : 17 : 6$.

$1266 : 5$ Val. of the Bales.
 1l : 1l : 1l : 1s : 1d :
 $100 : 10 : : 266 : 5$ $26\frac{5}{100}$
 Bales. 1l : 1s : 1d : Bale. 1l : 1s : 1d :
 $15 : 292 : 17 : 6 : : 1 : 19 : 10 : 6$
 Then

Then as 15 Bales to $l. 292 : 17 : 6 ::$ so is 1 Bale to $l. 19 : 10 : 6$; which is the Answer : for 15 Bales at $l. 19 : 10 : 6$, is $l. 292 : 17 : 6$, the Cost and Interest proposed.

Case 3.] A Merchant bought Broad-Cloth at $l. 20$ per Piece ready Money, and sold it again for $l. 25 : 10 : —$ per Piece, to be paid at the end of six Months : What does he gain per Cent. in 12 Months ?
Answer, $l. 55$ per Cent.

First say, As 20 the Cost to $l. 5 : 10 : —$ the Gain ::

So is $l. 100$ to $l. 27 : 10 : —$ the Gain in six Months.

Secondly say, As six Months to $l. 27 : 10 : —$

So is 12 Months to $l. 55$ the Gain per Cent. per Ann.

Case 4.] In Case of Loss you must deduct instead of adding. Thus a Merchant bought 20 Bags, containing 6020 lb Nett of Cotton for $l. 301$; but being damaged by Sea, he is willing to lose 10 per Cent. What must he sell it for per Pound, to lose that Sum ?

1st, You see by the first Proportion, that the Loss by the whole will be $l. 30 : 2 : —$; which deducted from the Cost, there remains $l. 270 : 18$.

$l.$	$l.$	$l.$	$l.$	Loss.
100.	10 ::	301.	30 : 2 : —	
		Deduct	30 : 2 : —	

Remains $l. 270 : 18 : —$

therefore as 6020 lb.

Cotton is to $l. 270 : 18 ::$ $lb 6020. l. 270 : 18 : — ::$ $lb 1. 10 : 3 \frac{4}{5}$ so is 1 lb. of Cotton to 10 d. $3 \frac{4}{5}$, the Answer.

This is sufficient to shew the Arithmetical Work of Loss and Gain : How the Account thereof (or of Profit and Loss) is kept in Books of Accounts, is shewn in my *Merchant's Magazine*. But this Book is not intended to be a Treatise of Merchandize, but to teach all kind of Arithmetic.

S E C T. VI. Fellowship.

Fellowship is the Application of the Rule of Proportion, shewing what share of Gain or Loss every Merchant of those who trade in company shall have, or bear in proportion to his share of the general Stock ; and consequently by this Rule also those who have underwritten Policies know how to settle their Averages, in case part of what is insured be lost, proportionably to what each has subscribed.

throwing over-board Goods to the Value of $l. 450$; what must each Subscriber bear of that Loss, in proportion to what he has insured?

The Proportion is as the whole Sum insured

	$l.$	$l.$ Loss.	$l.$	
is to the whole Loss	2300.	450 ::	1000.	$195\frac{1}{2} = A's \text{ Loss.}$
$l. 450$: so is the Sum	2300.	450 ::	750.	$146\frac{1}{2} = B's \text{ Loss.}$
each Insurer subscribed	2300.	450 ::	550.	$107\frac{1}{2} = C's \text{ Loss.}$
to his Proportion of the Loss, as appears by the Operation in the Margin.				

Sum for Proof, $l. 450$

Or if you would know what the Loss is *per Cent.* to make the Average; this is only done by one single direct Proportion thus, 2300. 450 :: 100. $19\frac{1}{2}$, which is the Rate *per Cent.* to be paid, as is proved

by multi- $A's$ 10 Hund. multipl. by the Rate $19\frac{1}{2}$ gives $l. 195\frac{1}{2}$
 plying the $B's$ 7 $\frac{1}{2}$ Hund. by the Rate $19\frac{1}{2}$ gives $l. 146\frac{1}{2}$
 100 $l.$ that $C's$ 4 $\frac{1}{2}$ by the Rate $19\frac{1}{2}$ produceth $l. 107\frac{1}{2}$
 each insu-
 red by the Rate *per Cent.* as in the Margin.

Quest. 4.] Three Men bought 120 Acres of Land for $l. 2400$; for which $A.$ was to pay $\frac{1}{3}$, $B.$ a 3d, and $C.$ a 4th of the Charge, and were to have the like Proportion of the Land: how much must each pay, and have of the Land, according to the true Intent and Meaning of their Contract? For to think that $\frac{1}{3}$, $\frac{2}{3}$, and $\frac{1}{4}$, will make but one, is absurd, because a 3d is more than a 4th, and $\frac{1}{3}$ and $\frac{2}{3}$ makes 1. The Answer is found as follows.

$\frac{1}{3}$ of Acres 120 is 60; and of $l. 2400 = 1200$.
$\frac{2}{3}$ is 40; and $l. 800$.
$\frac{1}{4}$ is 30; and $l. 600$.

Acres 130

Sums $l. 2600$

Too much by 10

and $l. 200$

Therefore I say, If 130 abate 10, and $l. 2600$ must abate $l. 200$; what must each abate, to answer the intended Contract? Thus;

Acr.	Acres.	$l.$	
130. 10 :: 60. $4\frac{2}{3}$	and if $l. 2600.$	200 :: 1200.	$92\frac{1}{3} = A's \text{ Ded.}$
130. 10 :: 40. $3\frac{1}{3}$	..... $l. 2600.$	200 :: 800.	$61\frac{1}{3} = B's$
130. 10 :: 30. $2\frac{2}{3}$	..... $l. 2600.$	200 :: 600.	$46\frac{2}{3} = C's$
Acres 10		Sums $l. 200$	

So

So that the Deductions of the respective Acres and Pounds being made (as *per* the Rules in Substraction of Fractions) from their apparent Shares, above,

The Answer is, $\left\{ \begin{array}{l} A. \text{ must have Acres } 55\frac{5}{13}, \text{ and pay } l. 1107\frac{7}{13}. \\ B. \text{ must have Acres } 36\frac{1}{13}, \text{ and pay } l. 738\frac{1}{13}. \\ C. \text{ must have Acres } 27\frac{2}{13}, \text{ and pay } l. 553\frac{2}{13}. \end{array} \right.$

Acres 120

Sums $l. 2400$ Proof.

Or the Analogys (or Proportions) above, may be done from the Parts each is to have, by reducing the Fractions $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$, into a common Denominator; as $\frac{6}{12}$, $\frac{4}{12}$, and $\frac{3}{12}$: For

As the Sum of the Numerators 12, is to 10, and to 200:

So is each Numerator 6, 4, and 3, to the Proportion that each is to deduct.

	Acres.		$l.$
Thus as 12. 10 :: 6.	$4\frac{2}{3}$	And as 12. 200 :: 6.	$92\frac{4}{3}$.
12. 10 :: 4.	$3\frac{1}{3}$	And as 12. 200 :: 4.	$61\frac{7}{3}$.
12. 10 :: 3.	$2\frac{2}{3}$	And as 12. 200 :: 3.	$46\frac{2}{3}$.

When Time is considered in Partnership, You must multiply the Money in Stock by the Time it continued therein, and work with the Products as by the Rules above, and as in the Example following.

Quest. 5.] A. and B. trade in Partnership for one Year. A. put into Stock $l. 200$, and at 4 Months end he withdrew $l. 40$, and at 9 Months end put in $l. 170$. B. put in at first $l. 150$, and at 7 Months end $l. 200$ more, and at the end of 10 Months he takes out $l. 160$: they gain 700, what must each have of it?

A's $l. 200 : 4$ Months is 800	} Sum of these Products	} 2590
$l. 160 : 5$ Months = 800		
$l. 330 : 3$ Months = 990		
B's $l. 150 : 7$ Months = 1050	} Sum of these Products	} 2480
$350 : 3$ Months = 1050		
$190 : 2$ Months = 380		
Sum Total =		5070

Then $5070. 700 :: 2590. 357\frac{3}{5} = A's$ Profit.

$5070. 700 :: 2480. 342\frac{2}{5} = B's$. Sum $l. 700 =$ the Proof.

Quest. 6.] A Ship's Company take a Prize worth 6000 $l.$ Now the Captor having on board the following Officers, Midshipmen and

and Sailors, who are each to participate of the Prize-Money according to his Pay and Time entred on board; which was thus.

8 Officers entred on-board 10 Mon. at 50 s. *per* Mo. } What must
10 Midshipmen 9 Mon. at 35 s. *per* Mo. } each have of
150 Sailors 8 Mon. at 25 s. *per* Mo. } the Prize ?

Mon.

8 mult. by 10, and that Prod. by 12 : 10, produceth 1200 :— :—
 10 mult. by 9, and that by 1 : 15, gives 157 : 10 :—
 150 by 8, and that by 1 : 5, is 1500 :— :—

Sum ... 1857: 10:—

Then I say,

As $1857\frac{1}{2} \cdot 6000 :: 200.$ $l. 646\frac{110}{3715}$ } To be divided equally
among the Officers.
 $1857\frac{1}{2} \cdot 6000 :: 157:10.$ $508\frac{2780}{3715}$, Among the Midshipm.
 $1857\frac{1}{2} \cdot 6000 :: 1500.$ $4845\frac{825}{3715}$, Among the Sailors.

Sum for Proof = 1.6000

SECT. VII. - Equation of Payments.

BY this Rule or Part of the Application of Arithmetic, Men discover, when several Payments are due at different Times, how to fix upon one certain Time when the whole may be paid at once, without Loss to the Debtor or Creditor.

The General and True Rule is,

As the Total of the Sums payable : is to a Unit (or 1 Month)
So is the Sum of the Products made of each Sum in its respective
Time,

To the true Time when the whole ought to be paid.

There is a certain Gentleman, who makes some figure in these kind of Sciences, and he denies the Truth of this Rule; which I shall prove under my second Question to be just, notwithstanding his Pretence of its being erroneous.

Quest. 1. *A.* is indebted to *B.* £100, to be paid at the end of three Months, also £200 to be paid at the end of 4 Months, and £300 to be paid at the end of 5 Months: Now to prevent the trouble of many Meetings, they agree to have but one Payment of the three Sums at one time; the Question is, when that must be, without loss to either *A.* or *B.*

Q

According

According to the foregoing Rule,

<i>l.</i> 100 multiplied by 3 Months, produceth 300	} Sum 2600. of the Products.
200 by 4 800	
300 by 5 1500	

l. 600 Sum.

l. Mon. *l.* Mon.

Then I say, 600. 1 :: 2600. $4\frac{1}{3}$

The Time sought is $4\frac{1}{3}$ Months; at the end of which time, if the *l.* 600 be paid, neither Party will sustain Loss, as I shall prove by and by.

Quest. 2.] *A.* oweth *B.* 5 Sums of Money to be paid at 5 Payments, viz.

l. 100 ready Money

200 at the end of $\frac{1}{2}$ a Month, or $\frac{1}{4}$ of a Year,

300 at 1 Month's end,

400 at 3 Months end,

500 at 6 Months end,

} At what time must
the whole be paid
without Loss to
A. or *B.*?
Answ. $3\frac{1}{3}$ Months

l. 100 ready Money.

200 multiplied by $\frac{1}{2}$ a Month = *l.* 100

300 by 1 Month = 300

400 by 3 Months = 1200

500 by 6 Months = 3000

1500 = Sum.

4600

Then as 1500. 1 :: 4600. $3\frac{1}{3}$ = the Answer.

Now that this is the true equated Time, will appear thus: For if the Interest of the respective Sums for their Times be equal to that of the whole for the equated Time, I think the Truth of the Answer can't be deny'd.

Now you'll find *l.* 100 ready Money Interest to be *l.* 0 : 0 : 0.

Interest of *l.* 200 for $\frac{1}{2}$ a Month at 5 per Cent. is — : 8 : 4

300 for 1 Month is — : 5 : —

400 for 3 Months is — : — : —

500 for 6 Mon. (all at 5 per Cent.) is 12 : 10 : —

the Sum = 19 : 3 : 4

Note, The In-
ter. for Months
I take from
that of a Year
proportionably.

And whoever will take the small pains to examine, will find, That the Interest of *l.* 1500 for $3\frac{1}{3}$ Months is the very same Sum. But no wonder he denies it, who denies the common Way of computing.

putting simple Interest, tho always practised by his Betters ; and he may as well pretend that it ought to be computed by way of Compound Interest for every 2d in the Year, as object what he has advanced against the general Ways and Rules given by every body but himself, for working Questions both in Interest and Equation of Payments, which I have in the last Example sufficiently proved to agree, tho I never did see the Truth of Equation proved this way before ; which I hope will be a Satisfaction to the Ingenious, as will also the Novelty of the last Question, &c.

And as a farther Proof to shew the Agreement of other Rules to the first, (or common one above) and that it is universally true for any Sum ; I will find the equated Time under the first Question, without taking notice of the Sums of Money, only the Parts of any Sum, and of the Time when payable. As,

Parts of any Sum.	Payable at these Mon.	Products of these two.	Being Months.	
$\frac{1}{2}$ at	3	$\frac{3}{2}$	$\frac{1}{2}$	} These 3 add.
$\frac{1}{3}$ at	4	$\frac{4}{3}$	$1\frac{1}{3}$	
$\frac{1}{2}$ at	5	$\frac{5}{2}$	$2\frac{1}{2}$	

Sum = the equated Time above = $4\frac{1}{2}$ as before.

And thus might the Equation of Time be reduced into Tables.

Quest. 3.] I lent my Friend
 l. 500 for 5 Months ; for what
 time must he lend me l. 750, to
 recompence my Kindness to him ?
 This is done as in the Margin.
 And for Proof of this,

l. Mon. l.

If 500. 5. 750

5

75) 2500 ($3\frac{1}{3}$ Months for An-
 1
 25

swer.

Interest at 5 per Cent. of l. 500 : 5 Months is l. 10 : 8 : 4.
 of l. 750 : $3\frac{1}{3}$ Months l. 10 : 8 : 4

SECT. VIII. Barter.

Barter or Commutation is a Rule among Traders, whereby they do, by considering the Price of their Goods, whether as for ready Money or advanced in Barter, so proportion the Rates and Quantities, as to know how much of one Specie may be exchanged for any quantity of another kind of Commodity. And all this is

discovered by that Golden Rule of Single Direct Proportion, as appears by the following Examples.

Quest. 1.] A. hath 1752 Ells of Linnen at 2 s. 9 d. per Ell; B. has Cheese at 31 s. per C. How much Cheese must B. give A. for his Linnen? See the Operation.

In this Case it will be necessary to know the Value of A's Linnen only in Shillings thus.

1st, 1752 } Mult.
 2 }

3504 at 2 s.

$\frac{1}{4}$ that = 876 at 6 d.

$\frac{1}{2}$ that = 438 at 3 d.

Shill. = 4818 Sum.

2dly, Then say, If 31 s. buy 1 C. of Cheese, what will 4818 s. buy? Answer, $155\frac{1}{3}\frac{1}{4}$.

s. C. Cheese. s.

31. 1 :: 4818 C.

31) $\frac{171}{1}$ ($155\frac{1}{3}\frac{1}{4}$

171

So that B. must give A.

$155\frac{1}{3}\frac{1}{4}$ C. of Cheese
 for his Linnen.

168

13.

Quest. 2.] A. has 52 Dozen of Hats (or 624) which he values at 2 s. 6 d. ready Money, but in Barter expects 2 s. 9 d. per Hat. B. has Cotton at 10 d. per Pound ready Money. How much Cotton must he give for the Hats, at a Price advanced in Barter proportionably to A's Advance in Barter?

1st say, If A's 2 s. 6 d. advance 3 d, what does B's 10 d. advance?
d. d. d. d.

30. 3 :: 10. 1 = B's Advance on a Pound of Cotton; so it is 11 d. per Pound in Barter.

2dly, The Value of 624 Hats at 2 s. 9 d. is d. 20592.
d. lb Cotton. d. lb Cott.

3dly say, If 11. 1 :: 20592. 1872 for Answer.

And for Proof of this, 624 Hats at 2 s. 9 d. each is l. 85 : 16 : —

And so is 1872 lb of Cotton at 11 d. per lb l. 85 : 16 : —

Quest. 3.] Two Merchants have various kinds of Goods to barter: A. has Indian Silk 735 Yards at 8 s. 6 d. but in Barter will have 10 s.

Canes 532 at 3 s. but will in Barter have 3 s. 4 d.

Muslin 16 Pieces at l. 4, but will have in Barter 4 l. 10 s.

B. has Scarlet Cloth at l. 1 per Yard,

Glass Manufacture at l. 0 : 1 : 8 per Pound, } Ready Money.

Ditto finer at ————— 2 : 4 per Pound, }

How

How many Yards of Cloth, and Pounds of each kind of Glafs, (of each a like Number) must *B.* give *A.* advancing his Goods proportionably also in Barter? To answer this Question,

1st, See what *A.*'s Goods amount to at his bartering Price thus:

735 Yards at 10 s. each, is $l. 367 : 10 : -$
 532 Canes at 3 s. 4 d. $l. 88 : 13 : 4$
 Mullin 16 Pieces at $l. 4 : 10 : -$ $l. 72 : - : -$ } Sum $l. 528 : 3 : 4$

2dly, The Difference between the Sums of *A.*'s ready Money and bartering Price, is 11 s. 10 d. therefore what *B.* must advance in proportion is thus:

As the Sum of the Ready-Money Rate of $l. 4 : 11 : 6$ of each of *A.*'s Goods,

Is to 11 s. 10 d. the Sum advanced upon one of each in Barter:

So is *B.*'s $l. 1 : 4 : -$ the Sum of one of each of his Goods,

To 3 s. 1 d. $\frac{27}{100}$ *B.*'s Advance in Barter; which must therefore be 27 s. 1 d. $\frac{27}{100}$ for the Price of 1 of each of his Goods.

3dly say, If 27 s. 1 d. $\frac{27}{100}$ buy 1 of each of *B.*'s Commodities, what will $l. 528 : 3 : 4$, the Value of *A.*'s Goods, buy of each of *B.*?

It will stand thus;

$l. \quad s. \quad d. \quad l. \quad s. \quad d.$
 $27 : 1 \frac{27}{100} : 11 : 528 : 3 : 4. \quad 389 \frac{36280}{35712}$

So that the Price of *A.*'s Goods will buy $389 \frac{36280}{35712}$ Yards of *B.*'s Cloth, and as many Pounds of each sort of his Glafs.

And for Proof of this you'll find that $389 \frac{36280}{35712}$ at 27 s. 1 d. $\frac{27}{100}$ each, (being a Set of *B.*'s Goods, or 1 of each) will amount to $l. 528 : 3 : 4$, the Value of *A.*'s Goods, according to his advanced Price in Barter.

Or you may find the Price in Barter that *B.* ought to rate each sort of his Goods: for,

B.'s Advance in Barter.

$l. \quad s. \quad d. \quad s. \quad d. \quad s. \quad s. \quad d.$

As *A.*'s $4 : 11 : 6. \quad 11 : 10 :: 20 :$ to $2 : 7 \frac{42}{100}$ on Cloth.

$4 : 11 : 6. \quad 11 : 10 :: 1 : 8.$ to $— : 2 \frac{644}{100}$ on Glafs.

$4 : 11 : 6. \quad 11 : 10 :: 2 : 4.$ to $— : 3 \frac{682}{100}$ on ditto.

And by these particular Prices of *B.*'s Goods, you may not only prove the Truth of the foregoing Operation, by seeing what

$389 \frac{36280}{35712}$ will amount to { $22 : 7 \frac{42}{100}$ per Yard of Cloth, } Whose 3 Products
 at { $1 : 10 \frac{644}{100}$ per lb of Glafs, } added together, will
 at { $2 : 7 \frac{682}{100}$ per lb ditto fine, } make $l. 528 : 3 : 4$.

But if you were not to deliver an equal Number of each, but according to any Proportion, you may now easily do the same.

And

And thus I have given the Reader a farther Account of the Usefulness and Extent of this Rule of Barter, &c. than has been done by any Author before, to make it agreeable to the other Parts of the Book foregoing; all which I doubt not but will be gratefully accepted by the Ingenuous Reader.

SECT. IX. Exchange.

AS the former or last Section exhibits Rules for the Bartering of one Commodity for another; so this shews how to exchange Money for Money, or, in the way of Negotiation, Money for Bills, &c. And therefore this is the proper place where Rules for Exchange ought to be inserted, as being another kind of Barter.

I shall not here trouble the Reader with an unnecessary and uncertain Account of the Value of foreign Coin of all Countrys, (about which most differ) because they who have Money to remit, must be governed by the Course of Exchange, and it is notorious that does rise and fall according as foreign Trade is influenced by several Circumstances relating to this or that Country; only I shall give the Weight and Value of the four several sorts of Pieces of Eight, because they are current in most places.

	Weight.		True Value.	
	dw.	gr.	s.	d.
The Piece of 8 <i>Pillar</i> —————	17	: 12	4	: 6 $\frac{1}{4}$
Piece of 8 <i>Sevil</i> —————	17	: 12	4	: 6
Piece of 8 <i>Mexico</i> —————	17	: 12	4	: 6
Piece of 8 <i>Peru</i> —————	17	: 12	4	: 5

And for the other Denomination of foreign Coin at Places which have Exchange with *England*, they are,

1. The Pound *Flemish* 33 s. 4 d. in Value 1 Pound *Sterling*; in which Denomination *London* exchanges with *Amsterdam*, *Rotterdam*, *Antwerp*, and *Hamborough*.
2. In Pieces of 8 *Mexico* for *English* Pence, *London* exchanges with *Madrid*, *Cadiz*, *Genoa*, *Leghorn*.
3. For Ducats (one being in real Value 4 s. 4 d. $\frac{1}{4}$ *Sterling*) *London* exchanges with *Venice*.
4. For the *French* Crown (in Value 4 s. 6 d. *Sterling*) *London* exchanges with *Paris*.
5. For the *Mill-rea* of 6 s. 8 d. $\frac{1}{2}$ *Sterling*, *London* exchanges with *Oporto* in *Spain*, and *Lisbon* in *Portugal*.

But

But the *Course of Exchange* is sometimes higher and lower than the Rates above, which are called *the Par of Exchange*.

6. I shall next shew the Nature of Exchanging by Bill; and 2dly, how to cast up Bills.

The first I cannot do more effectually than by giving the Form of a Foreign Bill, and that is thus:

Rotterdam, April 10. 1716. for l. 1272 : 13 : 4 Flemish at 33 s. 4 d. per Pound Sterl.
AT Usance pay this my first of Exchange unto Mr. Edward Jones, or his Order, Twelve Hundred Seventy-two Pounds Thirteen Shillings and Four Pence Flemish; Exchange at Thirty-three Shillings and Four Pence per Pound Sterl. for the Value received of Mr. John Hall, and account it to
 To Messieurs Andrea and Jean Varelst, Merchants in London.
 Your Humble Servant,
 Herman Vanderstagen.

Hence 'tis plain, that *Hall* pays the Money in *Holland*, (and is called the Remitter) to *Vanderstagen* (who is the Drawer) drawing his Bill on the *Varelsts* (his Correspondents at *London*) to pay the Value to *Jones* at *London*, who is *Hall's* Correspondent.

And thus there are, you see, four Persons concerned in a Bill of Exchange, viz. the Remitter, the Drawer, he that pays the Bill, and he to whom it is paid. Note, *Usance* is the Time between any Day of one Month to the same Day of the next.

7. The next thing is to shew how this Bill, &c. is converted into Pounds, &c. Sterling Money, which is the principal thing intended by the Rule of Exchange as 'tis here placed; i. e. to shew how to reduce one Country's Coin to another.

l. s. d. Flemish 1272 : 13 : 4 20 s. d. 33 : 4 12	A shorter Way thus: l. 1272 : 13 : 4 Flem. 3 mult. <hr/> Divide by 5) 3818 : 00 : 0 Answer = l. 763 : 12 : -- Sterl.
Pen. Elem. 400) 305440 (763 l. 1 25 14 240 refts l. 20 s. mult. 400) 4800 (12 s. 1 0	

So that in $l. 1272 : 13 : 4$ *Flemish* there are $l. 763 : 12 : —$ *Sterling*. And thus *Dutch Money* may be reduced to *English* at any Rate per Pound *Sterling*; but in the above, of $33 s. 4 d.$ *Flemish* per Pound, the Work is performed much shorter, as above toward the right-hand Margin.

8. And if a Bill is drawn from *Lisbon* of *Mill-rea's* 1432 at $6 s. 10 d. \frac{1}{2}$ *Sterling* per *Mili-rea*; how much *English Money* is that Bill?

<i>Mill-rea.</i>	<i>s.</i>	<i>d.</i>	<i>Mill-reas.</i>
1.	6	$10 \frac{1}{2}$	1432
			$1432 \text{ at } 6 s. 10 d. \frac{1}{2}$

By Practice, $\frac{2}{3} = 477 : 6 : 8$
 and $\frac{1}{10} = 11 : 18 : 8$

And 1432 multip. by 5, and divided by 8 = $3 : 14 : 7$

Answer, *Sterling* = $l. 492 : 19 : 11$

9. Now suppose the *Dutch Bill* above be endorsed and sent to *Leghorn*, at $56 d.$ *Sterling* per Piece of 8; and if it be again endorsed at *Leghorn*, and remitted to *Amsterdam*, the Exchange at $93 \frac{1}{2}$ Pence *Flemish* per Piece of 8: how many Pieces of 8 must be paid for the Bill at *Leghorn*, and how many Pounds *Flemish* at *Amsterdam*, according to this Course of Exchange?

1st, In $l. 763 : 12$ in the Bill, there are 183264 Pence *Sterling*; which divided by 56, gives $3272 \frac{4}{7}$ Pieces of 8.

2dly, $3272 \frac{4}{7}$ being multiplied by $93 \frac{1}{2}$ Pence *Flemish* for each Piece of 8, or $2290 \frac{4}{7}$ by $187 \frac{1}{2}$ produceth $644424 \frac{4}{7}$ Pence *Flemish*; and being divided by 12, and then by 20, gives Pounds *Flemish* $l. 1272 : 13 : 4$ as above, which proves the Truth of the whole Work.

10. But these Questions will be too easy to those who have proceeded gradually to learn thus far, that I need not enlarge much farther on this Rule of Exchange; what has been observed being sufficient to shew how either the Coins, or Weights and Measures of one Country, are reduced to those of any other.

For in 32755 *Flemish* Ells there are 19653 *English*; for a *Flemish* Ell is $\frac{3}{4}$ of an *English*, or $\frac{6}{8}$ rather, because it saves the Work of Division.

11. A *Dutchman* sells 29380 *Flemish* Ells of *Holland* Duck to an *Englishman*, a *Spaniard*, an *Italian*, and a *Portuguese*, who are to have each a like quantity in their own Country Measure; how much must each have therein?

The

The *Dutch* in *English* Ells are 17628, and

17628 Ells divided by 4, gives 4407 Ells *English* each, and
Ells. Answer.

4407 is for the *Briton* ————— 4407 Ells.

4407 for the *Spaniard* at $\frac{7}{1}$ Canes per Ell *English* 3084 $\frac{2}{1}$ Canes.

4407 for the *Italian* at 2 Braces per Ell *English* 8814 Braces.

4407 for the *Portuguese* at 1 Vare per Ell is ——— 4407 Vares.

This may be proved several ways, which I leave to the Reader's Judgment.

SECT. X. Alligation.

ALLIGATION may be called *The Rule of Mixture*, or of *compounding Ingredients*, because it teaches how to mix several Species of *Simples* according to any Intent or Design proposed. It is either *Medial* or *Alternate*.

Alligation Medial shews what the mean Price of a Pound, Ounce, &c. is worth, when several Quantities of several Values are mix'd together, &c. as per the Cases following.

Alligation Alternate shews how much of various kinds of *Simples* may be taken to make up any assigned Quantity of a Compound, which shall be worth a Price proposed.

Of Medial Alligation.

Case 1.] A Goldsmith hath Gold 12 $\frac{3}{4}$ at 4 *l.* per $\frac{3}{4}$; 8 $\frac{3}{4}$ at *l.* 4 : 5; 3 $\frac{3}{4}$ at *l.* 4 : 6 : 8; and 9 $\frac{3}{4}$ at *l.* 4 : 13 : 4 per Ounce: what is an Ounce worth, suppose these be all melted down together? Answer, *l.* 4 : 7 : 5 $\frac{1}{2}$.

Rule.] Multiply each Quantity given by the Price; then by direct Proportion,

As the Sum of the Quantities given

Is to the Sum of the said Products;

So is one Ounce of the Mixture

To its Value. See the Work following.

Ounces Gold. The Price of 1 $\frac{3}{4}$.

12 multiplied by *l.* 4 : — the Product is *l.* 48.

8 by 4 : 5 produceth ——— 34.

3 by 4 : 6 : 8 produceth ——— 13.

9 by 4 : 13 : 4 produceth ——— 42.

32 Sum.

137 Sum.

R

Then

$$\begin{array}{r} 32. \quad 137 \\ 3. \quad 1. \quad 3. \quad 1. \end{array}$$

Then say, $32. 137 :: 1. 4\frac{1}{2}$, or (to $l. 4 : 5 : 7\frac{1}{2}$.

And by the same Rule the Value of any other Quantity of that Composition is found: as suppose 7 in the last Example is worth $29\frac{1}{2}$, for as

$$\begin{array}{r} 32. \quad 137 \\ 3. \quad 1. \quad 3. \quad 1. \end{array}$$

$$32. 137 :: 7. 29\frac{1}{2}$$

Case 2.] To increase or diminish a Compound proportionably, by knowing the several Quantities of the Simples in the Composition.

Rule. As the Sum of the particular Quantities of the Compound given

Is to the whole Quantity proposed to be augmented or lessened:

So is each particular Quantity in the given Compound

To the due Proportion required of that Specie, Fineness, &c.

Example. I would augment the Compound in the last Case to $48\frac{1}{2}$, that is, I would add 16 to the 32; how much must I take of each simple Ingredient? See the Operation.

12		<i>Answer.</i>
8	Then as	$32. 16 :: 12. 6$
3		$32. 16 :: 8. 4$
9		$32. 16 :: 3. 1\frac{1}{2}$
<hr style="width: 50px; margin: 0;"/>		$32. 16 :: 9. 4\frac{1}{2}$
Sum = 32		<hr style="width: 50px; margin: 0;"/>

Sum = 16 Proof to add.

So that I must have $18\frac{1}{2}$ of $l. 4$ per $\frac{1}{2}$.

$12\frac{1}{2}$ of $l. 4 : 5 : —$

$4\frac{1}{2}$ of $l. 4 : 6 : 8$, and

$13\frac{1}{2}$ of $l. 4 : 13 : 4$.

48 Sum for Proof, in the whole.

Case 3.] Having the Simples of any Compound given, to find how much of each kind of simple Ingredient is in any part of that Composition.

Rule. As the Total of the Composition

Is to the Quantity of any Simple in that Composition:

So is the Total Quantity proposed to be proportionably compounded,

To the Quantity of each Simple to be in that proposed Quantity.

Example.

Example. I would know how much of each Ingredient (or Price of Gold mention'd in the first Case) is in a Pound or 12 $\frac{3}{4}$ of the 32, being the Compound given? See the Operation in the Margin.

Answer.

$$\begin{array}{rcl} 32. 12 :: 12. & 3 & 4\frac{1}{4} \text{ of } l. 4 \text{ per } \frac{3}{4}. \\ 32. 12 :: 8. & 3 & \text{ of } 4 : 5 : - \\ 32. 12 :: 3. & 1\frac{1}{8} & \text{ of } 4 : 6 : 8 \\ 32. 12 :: 9. & 3\frac{1}{2} & \text{ of } 4 : 13 : 4 \end{array}$$

$\frac{3}{4}$ 12 Sum Proof.

Case 4.] The Total of the Compound of two Simples, with the Total Value of that Composition, and the Value of a Unit of each Simple being given; to find the Quantity of each simple Ingredient in the Composition.

Rule. Multiply the Total Quantity of the Composition, (here 20) by the lesser Price of the Unit (here 4) then deduct the Product from

	Gold at $l. 4$ per $\frac{3}{4}$.	
	Ditto at $l. 4 :$	
Total of the } = 20 $\frac{3}{4}$.	Total Value $l. 82$	
Composition }	80	
<u>4</u>	<u>80</u>	
80	$l. \frac{2}{4}) \quad 2 (8$	

the Total Value of the Composition (here 82) and divide the Remainder by the Difference in Value of a Unit of the two Simples given (as here $\frac{1}{4}$ s. or $\frac{1}{4}$ of a Pound) and the Quotient is the Quantity of the higher-prized Simple (here 8) whose Complement to 20 is 12: so that the Answer is 12 $\frac{3}{4}$ of $l. 4$ per Ounce, and 8 $\frac{3}{4}$ of $l. 4 : 5$ per Ounce. This Canon I discover'd by Algebra, as appears in the Solution of Questions by various Positions.

Case 5.] To find the Quantities of each simple Ingredient (when those Simples are more than 2 in Number) contained in a Composition, by having the Totals of the Quantity compounded, and of the Value; and also the Value of a Unit of each simple Ingredient given, as

$$\begin{array}{rcl} \frac{3}{4} \text{ of Gold at } l. 4 \text{ per } \frac{3}{4} & = & \\ \frac{3}{4} \text{ ditto at } l. 4 \frac{1}{4} & = & \\ \frac{3}{4} \text{ ditto at } l. 4 \frac{1}{2} & = & \\ \frac{3}{4} \text{ ditto at } l. 4 \frac{2}{3} & = & \end{array}$$

Total of the Composition = 32 $\frac{3}{4}$. Total Value $l. 137$

Rule. To these kind of Questions, as in those of Alligation Alternate, various Answers may be given, and yet all true. You may best

best do them by 2 at a time, as in the last Case. I suppose the 2 first 15 of the total Mixture, and 63 of the total Value, and so I find 3 at $l. 4$, and 12 at $4\frac{1}{4}$. Then the rest of the total Compound is 17, and of the Value 74; which, according to the 2 latter Prices, gives 16 at $4\frac{1}{3}$, and 1 at $4\frac{2}{3}$.

But *note*, That you must so discreetly divide the total Quantity, and value that when the Product of the 1st in 1 of the 2 Prices is taken from the latter, the Re-

mainer may not be so much as (when divided by the Difference of the Prices) will give a Quotient so great as that part of the total Quantity of the Ingredient which you fix'd upon, or supposed. See the Operation above.

II. Alligation Alternate.

Quest. 1. A Farmer hath 4 sorts of Wheat, viz. 5 s. 6 s. 7 s. and 7 s. 6 d. per Bushel; and he is minded to mix so much of each sort, as will make 64 Bushels worth 6 s. 6 d. per Bushel: how much of each sort must he take?

Having placed the Prices as you see, and the mean Price; take the Difference between the mean Price 6 s. 6 d. and 5 s. (the 1st Price) which is 1 s. 6 d. this you must put down (in the 1st Way) against 7 s. 6 d. (because bigger than the

1st 2=15	and =63
4	less...60 deduct.
Product = 60	$\frac{1}{4}$) 3 (12 at $4\frac{1}{4}$.
2dly 15	63 deduct.
$4\frac{1}{4}$	$63\frac{3}{4}$
Product = $63\frac{3}{4}$	$\frac{1}{4}$) $\frac{3}{4}$ ($\frac{1}{4} = 3$ at 4.
the 2d 2=17	and 74
$4\frac{1}{3}$	$73\frac{2}{3}$ deduct.
Product = $73\frac{2}{3}$	$\frac{1}{3}$) $\frac{2}{3}$ (1 at $4\frac{2}{3}$.
lastly 17	74 deduct.
$4\frac{2}{3}$	$79\frac{1}{3}$
$79\frac{1}{3}$	$\frac{1}{3}$) $5\frac{2}{3}$ ($\frac{4}{3}$ or 16 at $4\frac{1}{3}$.

Prices.		Differences.	
s.		s.	d.
5		1	0
s. d.	6	0	6
The mean Price 6 : 6			
	7	0	6
	7 : 6	1	6
		3 : 6 = Sum.	

the 1st Way.

mean

mean Price.)
Then go on,
and put the
Difference be-
tween 6 s. 6 d.
the mean Price,
and 6 s. (the 2d
Price) which is
6 d. against the
Price (7 s.) be-
cause bigger
than the mean
Price. Then put

<i>A Second Way.</i>			
	s.	s.	d.
	5	0	6
s. d.	6	1	0
6 : 6	<hr/>		
	7	1	6
	7 : 6	0	6
<hr/>			
Sum = 3 : 6			

<i>Third Way.</i>				<i>Sums.</i>	
	s.	s.	d.	s.	d.
	5	0	6 ; 1 s.	1	6
s. d.	6	0	6 ; 1	1	6
6 : 6	<hr/>				
	7	1	6 ; 6 d.	2	0
	7 : 6	1	6 ; 6 d.	2	0
<hr/>				<hr/>	
Sum Total = 7 : 0					

the Difference between 6 s. 6 d. and 7 s. (the 3d Price) against 6 s. because that is less than the mean Price. Lastly, the Difference between 6 s. 6 d. and 7 s. 6 d. is 1 s. which put against 5, the first Price. And thus having put the Differences between the mean Price and those less than it against the Prices bigger than the mean Price ; and the Differences between the mean Price and those greater than it, right against those that are lesser alternately ;

2dly, Sum up the Differences, which you see is 3 s. 6 d.

3dly, Say by the single Rule of Proportion Direct,

<i>The Sum of the Diffe- rences.</i>	<i>Bushels the whole Mix- ture.</i>	<i>The Dif- ferences.</i>	<i>Bushels required.</i>
s. d.		d.	
As 3 : 6.	64 ::	12.	$18\frac{1}{4}\frac{2}{2}$ of that of 5 s. per Bushel.
3 : 6.	64 ::	6.	$9\frac{6}{4}\frac{2}{2}$ of that of 6 s. per Bushel.
3 : 6.	64 ::	6.	$9\frac{6}{4}\frac{2}{2}$ of that of 7 s. per Bushel.
3 : 6.	64 ::	18.	$27\frac{1}{4}\frac{8}{2}$ of that of 7 s. 6 d. per Bush.

Sum (or Proof) 64 being the whole Mixture.

The Proportions by the second Way of placing the Differences are thus :

s.	d.	d.	
3 : 6.	64 ::	6.	$9\frac{6}{4}\frac{2}{2}$ Bushels of 5 s. per Bushel.
3 : 6.	64 ::	12.	$18\frac{1}{4}\frac{2}{2}$ Bushels of 6 s.
3 : 6.	64 ::	18.	$27\frac{1}{4}\frac{8}{2}$ Bushels of 7 s.
3 : 6.	64 ::	6.	$9\frac{6}{4}\frac{2}{2}$ Bushels of 7 s. 6 d.

64 Sum for Proof

And

And the Proportions by the third Way of placing the Differences are still various. Thus,

s.	d.	d.	
As 7 or	84	64 :: 18.	$13\frac{6}{7}$ Bushels at 5 s. per Bushel.
	84	64 :: 18.	$13\frac{6}{7}$ Bushels at 6 s.
	84	64 :: 24	$18\frac{2}{3}$ Bushels at 7 s.
	84	64 :: 24	$18\frac{2}{3}$ Bushels at 7 s. 6 d.

64 Sum as before.

In the 2d Way you see that the Difference between the mean Price and 5 s. is placed against the Price 7 s. and 6 s. against 7 s. 6 d. 7 s. against 9 s. and between the 6 s. 6 d. and 7 s. 6 d. against 6 s.

And in the 3d Variety,

	s.	d.		s.	s.	d.
The Difference between—	s.	d.				
	6 : 6	&	$\left\{ \begin{array}{l} 5 \\ 6 \\ 7 \end{array} \right.$	is placed against	$\left\{ \begin{array}{l} 7 \text{ \& } 7 : 6 \\ 7 \text{ \& } 7 : 6 \\ 5 \text{ \& } 6 \\ 5 \text{ \& } 6 \end{array} \right.$	
			$\left\{ \begin{array}{l} 5 \\ 6 \\ 7 : 6 \end{array} \right.$	the Prices—		

So that the Difference between the mean Price and those less than it are placed against all those greater than it ; and the Difference between the mean Price and those greater are placed against all those that are lesser than it. Then the Sum of the Differences in each Line are added together in the Column next the right hand ; as 6 d. and 1 s. in the middle Column is 1 s. 6 d. in the third Column ; and 1 s. 6 d. and 6 d. is 2 s. So the Sum of that third Column is 7 s. and thus ariseth the Numbers in proportion, in the third Way or Variety.

Hence you see, that there are three different Answers to one Question, and yet they are all true, as fully giving what is required in the Demand ; whence (as well as from placing the Differences in each) it may justly be called *Alternate Alligation*. And for a thorough and intire Proof of this, I shall shew that 64 Bushels at the mean Price 6 s. 6 d. per Bushel, is (in the last or most abstruse, tho best Way of the three Varietys) the same Amount as each of the Quantitys exhibited for Answers, being cast up at the Prices given, and added together, amount to. Thus,

64 Bushels

64 Bushels } the whole to be mix'd at the mean
Price 6s. 6d. amounts to } l. 20 : 16 : 0

So also 13 $\frac{6}{8}$ Bush. of 5s. per Bush. comes to l. 3 : 8 $\frac{4}{8}$
 13 $\frac{6}{8}$ of 6s. l. 4 : 2 $\frac{4}{8}$
 The Clear Proof of the Operation. 18 $\frac{2}{8}$ of 7s. l. 6 : 8
 18 $\frac{2}{8}$ of 7s. 6d. l. 6 : 17 $\frac{1}{4}$

64 Sum of the Sorts. Sum = l. 20 : 16 = Tot. Value,
ut supra.

I shall give one other Example, where there is only one Price
 lesser than the mean Price ;
 and this I shall do accord-
 ing to the Method of the
 third Variety foregoing,
 that being the best, as ma-
 king the equallest Mixture :
 where it is required to
 know how much of 2, 5, 9,
 and 17 must be taken to
 make 100 of, or worth 4.
 See the Operation in the
 Margin.

Prices given.	Differences of the Prices and the mean Price.	Sum of each Line of Differ.
2 s. — 1, 5, 13, = 19		
4 — the mean Price.		
5 — 2	= 2	
9 — 2	= 2	
17 — 2	= 2	

And this is proved as before,
 thus :

76 at 2 = 152
 8 at 5 = 40
 8 at 9 = 72
 8 at 17 = 136

Sum = 400 = 100 at 4.

Sum of all the
 Differences } 25

Answer.

Now 25. 100 :: 19. 76 at 2 s.
 25. 100 :: 2. 8 at 5
 25. 100 :: 2. 8 at 9
 25. 100 :: 2. 8 at 17

Note, That if the Prices given were even so many, the Method
 is the same.

SECT. XI. The Rule of False.

THIS is so called not because it requires any more Conjunction, or is more difficult to comprehend or perform than some of the Rules preceding; but it's properly called *The Rule of False Supposition*, because by supposing Numbers to be the Answers to Questions which are not really so, but are feigned or supposed at pleasure, we do by such false or fictitious ones discover the true Numbers required.

An Example or two will illustrate this, and I shall not insist farther, because the Solution of an easy simple Equation in Algebra answers not only any Question in this Rule, but also gives at the same time a Canon whereby any Question of the like kind is much more easily and speedily resolved.

Quest. 1.] Three Merchants built a Ship, which cost *l.* 1600. *A.* paid a Sum not known, *B.* paid double to *A.* within *l.* 50, *C.* paid as much as *A.* and *B.* wanting *l.* 100: What did each pay of the Cost?

	Operation Column.	Suppositions.	Errors.
1st, Suppose <i>A.</i> paid _____	<i>l.</i> 200	200	
Then, according to the Question, <i>B.</i> paid _____	350		
And <i>C.</i> paid _____	450		
	Sum 1000		
But it should have been <i>l.</i> 1600, therefore the Error is _____		...	600
2d, Suppose <i>A.</i> paid _____	250	250	
Then it follows that <i>B.</i> paid _____	450		
And <i>C.</i> paid, (according to the Question) —	600		
	Sum 1300		
Which is therefore still too little by .....		.....	300
Then multiplying the 1st Position by } the 2d Error, gives _____	60000		
And the 2d Suppos. in the 1st Error, gives —	150000		
The Difference of the Product is =	90000		
Which divided by the Differ. of the Errors (300)			
The Answer is, that <i>A.</i> put in _____	300		
Then <i>B.</i> put in _____	550		
And <i>C.</i> —	750		
	Sum for Proof 1600		

Here

Here you see, that the Suppositions and Errors being multiplied, you divide the Difference of the Products by the Difference of the Errors, which you must always do when the Errors are both Surplusages, or both Deficiencies of the supposed Numbers.

But if the one Error is caused by supposing too much, the other by supposing too little; then you must divide the Sum of the said Products by the Sum of the Errors, and the Quotient is the Answer, as in the next Example appears: which Rule you may retain in mind by this Distich;

*When Errors are not both of the same kind,
To add the Products, as the Errors, mind:
But if they're both too small, or both too much,
Subtraction must be us'd, in Cases such.*

Quest. 2.] Admit a Church hath a Choir (or Chancel) 40 foot long; and that the Ground taken up by the Belfrey is $\frac{1}{4}$ of the Chancel, and $\frac{1}{2}$ of the Nave, or Body; the Nave (or Body of the Church) is 3 times the Length of the Belfrey, and $\frac{3}{4}$ the Chancel: how long is the whole Church within the Walls, and every Part of it?

First find the Length of the Nave or main Body of the Church, for then the rest are discovered, thus:

	The Operation.	Suppositions.	Errors.
1. Suppose the Nave be		150	
$\frac{1}{4}$ of that is	25		
$\frac{1}{4}$ of the Chancel	10		
Sum, is the Belfrey	35		
Then the Nave (according to the Question) is 3 times that	105		
And $\frac{3}{4}$ of the Chancel, viz.	30		
Sum is but	135		
Which being less than 150 supposed, the Error is			15
2. Suppose the Nave be		102	
$\frac{1}{4}$ of that is	17		
$\frac{1}{4}$ of the Chancel is	10		
The Sum or Belfrey is	27		
3 times that Belfrey is	81		
$\frac{3}{4}$ of the Chancel is	30		
Sum is	111		
Which being more than the 102 supposed, the Error is			9
S			Now

Now the Product of 150 by 9 is 1350
 And of the 102 by the Error 15, gives 1530

Which 2 Products I am to add according
 to the Rule, because the 1st Error was the ef-
 fect of supposing too much, the 2d of supposing
 too little; and the Sum is 2880

That divided by the Sum of the Errors = 24 } = 120
 gives the Length of the Nave of the Church }

And the Chancel being = 40

And the Belfrey $\frac{1}{6}$ of 120 and $\frac{1}{4}$ of 40 is = 30

The Length of the whole Church is = 190

And you'll find these 3 Dimensions (120, 40, and 30) to answer in
 all respects what is proposed in the Question, which is a Proof of
 the Work.

And thus you have a clear and perspicuous Method of solving
 Questions in this Rule of False Position; which may suffice till we
 come to Algebra, where the Reader will find a great Variety of
 Problems answered the best and shortest way, consistent with de-
 monstrative Plainness.

The Canon for answering Questions of like nature with the 1st, is
 this: Divide the whole Value of the Ship, more twice what *B.* abate-
 teth of paying double to *A.* more what *C.* abateth of paying as much
 as *A.* and *B.* by 6, and the Quotient is what *A.* paid. And this Ca-
 non holds, vary the Numbers as you please, keeping to the Words.

The Canon answering Questions of like nature with the 2d, is,
 Whatsoever Length the Chancel of the Church is, if that be multi-
 plied by 3, it gives the Length of the Body of the Church propor-
 tioned as in the Question, as 3 times 40 is 120. But if you suppose
 the Chancel 60, then is the Nave 180, and the Belfrey 45, in all
 285. For Proof $\frac{2}{6}$ of the Nave, and $\frac{1}{4}$ of the Chancel 60, is 45 =
 the Belfrey; and 3 times that (or 135) added to $\frac{1}{4}$ of the Chancel,
 is 180.

Single Position.

But there are some Questions answer'd by one single Supposition,
 with the help of the Rule of Proportion. As for

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Example.] Three Men build an House, which cost £. 300. *A.* paid a Sum unknown, *B.* paid twice as much, and *C.* paid 3 times so much; what did each pay of the £. 300?

I suppose *A.* £. 40, then *B.* must pay 80, and *C.* = 120; the Sum of which is but £. 240, instead of £. 300. Then I say,

If 240 doth arise from supposing 40,

What Number will 300 be the Result of?

The Answer is 50; for

$$240 : 40 :: 300 : 50$$

Now that 50 is the Sum that *A.* paid, may be proved thus:

$$\begin{array}{l} A. = 50 \\ B. \text{ paid} = 100 \\ C. \text{ paid} = 150 \end{array} \left. \vphantom{\begin{array}{l} A. = 50 \\ B. \text{ paid} = 100 \\ C. \text{ paid} = 150 \end{array}} \right\} \text{Sum} = 300 \text{ for Proof.}$$

Here ends Vulgar Arithmetic.

C H A P. III.

Decimal Arithmetic.

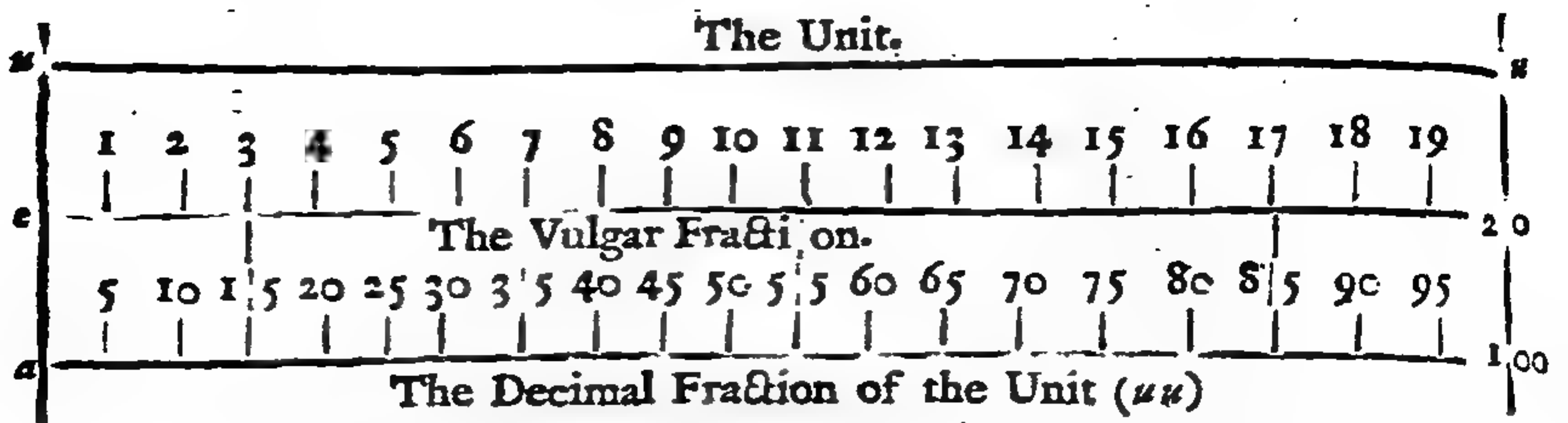
S E C T. I. *Notation and Numeration.*



THIS kind of Arithmetic takes its Name from the Nature of the Denominator, which is always 10, or some Power of 10; in which only it differs from a Vulgar Fraction: for as that has any promiscuous Number for its Denominator, so a Decimal Fraction hath always 10, 100, 1000, 10000, &c. for its Denominator.

2. Hence 'tis easy (the Denominators of Decimals being so few in comparison of Vulgar, and so certain) to express a Decimal Fraction without its Denominator, by separating so many places of the Numerator, as the Denominator hath of Cyphers, by a Point: Thus $\frac{5}{10}$ is wrote .5; $\frac{25}{100}$ is .25; $\frac{75}{1000}$ is .075, &c. And if (as in the last) there be not so many places in the Numerator as there are Cyphers in its Denominator, you must make up that Number by placing a Cypher or Cyphers towards the left hand of the Numerator.

3. The Nature of a Decimal Fraction will farther appear by what follows :



The uppermost Line (uu) is a Unit ; the Line (e 20) is of Vulgar Fractions of that Unit, whose common Denominator is 20 ; and the Line (a, 100) is of Decimal Fractions of the Line (uu) whose Denominator is 100.

And here the Decimal Fraction $\frac{15}{100}$ or .15 is equal to the Vulgar Fraction $\frac{3}{20}$; .35 is equal to $\frac{7}{20}$; .85 equal to $\frac{17}{20}$, &c.

4. But that you may be the better able to read or write down any Decimal Fraction properly, take the following Table ; the Words at the head of which shew how to read the Numerator, and those toward the right hand, to read the Denominator.

<div style="display: flex; justify-content: space-around;"> <div> Hundred Twenty Three </div> <div> Hundred Fifty Six </div> <div> Hundred Eighty Nine. </div> </div>										
. 0	1	2	3	4	5	6	7	8	9	Ten Thousand Million
. 0	2	3	4	5	6	7	8	9		Thousand Million
. 2	3	4	5	6	7	8	9			Hundred Million
. 3	4	5	6	7	8	9				Ten Million
. 0	5	6	7	8	9					Million
. 0	0	7	8	9						Hundred Thousand
. 0	0	0	9							Ten Thousand
. 7	8	9								Thousand
. 8	9									Hundred
. 9										Tenth

5. There is not, nor can be any Fraction invented, so easy to work, because so like to an intire Number, as the Decimal: for there is the same Increase of the Places Values in these as in Integers, as appears by the following Table, from the One Hundred Millionth Part of a Unit to 100000000 of Units, as $\text{111111111.111111111}$; and thus every place towards the left hand is ten times that towards the right.

$\frac{1}{100000000}$	Parts; 10 times that, is
$\frac{1}{10000000}$	Parts; 10 times that, is
$\frac{1}{1000000}$	Parts; 10 times that, is
$\frac{1}{100000}$	Parts; 10 times that, is
$\frac{1}{10000}$	Parts; 10 times that, is
$\frac{1}{1000}$	Parts; 10 times that, is
$\frac{1}{100}$	Parts; 10 times that, is
$\frac{1}{10}$	Parts; 10 times that, is
1	or a Unit; 10 times that, is
10	or 10 Units; 10 times that, is
100	; 10 times that, is
1000	; or 10 times that, is
10000	; 10 times that, is
100000	; 10 times that, is
1000000	; 10 times that, is
10000000	; 10 times that, is
100000000	; &c.

6. Decimals are produced from Vulgar Fractions, they being the Quotients arising by dividing the Numerator, (with Cyphers annexed toward the right hand) by the Denominator. Hence it follows, that some Decimals are *Compleat*, and others *Infinite*.

7. I call that a *Compleat Decimal*, when nothing remains of the said Division by which the Decimal is made. And to distinguish a *Compleat Decimal*, you may put

a Period after the last Figure towards the right hand thus .0125. and .00375. And those not having such Mark, are supposed to be *Infinite*.

The more Places an *Infinite Decimal* consisteth of, the more it expresseth the Truth.

I call that an *Infinite Decimal*, which is no Aliquot Part of the Dividend by the Divisor that produceth such Decimal, but something will always remain in dividing.

Infinite Decimals are composed either of uncertain Digits, as .146129, &c. or of those certain and known, as .333, &c. .44444, &c. The former of these ought to have places more or less, according to the Use that is to be made of them, (for which I have given a Table to direct at the beginning of Division, Sect. 6. following.) But *Infinite Decimals* composed of certain Digits, may for shortness.

shortness be wrote thus : The Decimal of $\frac{1}{3}$ which is .33333333, &c. may be .3r that is, 3 repeated infinitely ; or if a Digit repeat after others are in the Quotient, they will stand thus :

.83 r 1 which shews that 1 (or the 3) is only repeated.

.285714285714, &c. hath 6 repeating, wrote thus .285714 r 6 And shews that 6 of the Digits next the left hand would be repeated by carrying on the Division *ad infinitum*. And these by some are called circulating Numbers, all which kinds of Decimals are produced by Division thus :

Divi- sors.	Digits divided.	Decimals arising.	Divi- sors.	Digits divided.	Decimals arising.
9	8.0	.8 r	7	6.000000	.857142 r 6
	7.0	.7 r		5.000000	.714285 r 6
	6.0	.6 r		4.000000	.571428 r 6
	5.0	.5 r		1.000000	.142857 r 6
	1.0	.1 r	6	5.00	.83 r 1
8	7.000	.875.		4.	.6 r
	5.000	.625.		1.00	.16 r 1
	3.000	.375.	5	4.0	.8.
	1.000	.125.		3.0	.6.

A mixt Number (or one composed of a whole Number and Decimal) is thus written 365.125. ; 1728.34617, and 252.6r, &c.

And this shall suffice to shew the Nature of Decimals, and how to read and write any. I shall next pass on to Reduction, and the rest of the Rules, inserting only such Examples as are likely to accrue in Practice ; and avoiding all those that are impertinent, and tend to perplex the Reader, and make this Part of Arithmetic abstruse and tedious, which in reality is most easy and obvious.

SECT. II. Reduction of Decimals.

IT is almost as improper to treat of Addition and the other Rules before this of Reduction in Fractions, as to teach Reduction before the Parts of single Arithmetic in Integers : for what can be more irregular, than to shew how to add, subtract, &c. those Numbers, which you neither know the Production of, nor how to discover

discover what Parts of Coin, Weight, &c. they represent or include? Therefore

I shall, as is usual, as well as justly and methodically done, in the next place shew how to reduce Vulgar Fractions of inferior Denominations to Decimals of superior, considered as Integers of those Fractions; and, by way of Proof thereof, give Rules and Examples to find the Values of those Decimals or any other.

I. To reduce Vulgar Fractions into Decimals.

A Decimal of 4 places; nay generally of 3, is sufficient, when that Decimal is not to be multiplied by any Number: Therefore the Denominator of a Decimal of 4 places being (as shewed before) 10000, the Proportion will be for any Fraction in general, to find the Numerator of such a Decimal;

As the Denominator of the Fraction given

Is to the Numerator of that Vulgar Fraction ::

So is the Denominator of the Decimal (admit 10000)

To its Numerator, or the Decimal required.

Example.] What is the Decimal of $\frac{37}{100}$?

Here it may be ob-

served, Rule = As 39. 27 :: 10000. .6923 = the Answer.

1st, That a Cypher

next the right hand of

my Decimal may be

omitted, because the

same place in the De-

nominator is a Cypher

also: Thus $\frac{139}{10000}$ is

$\frac{139}{10000}$, and $\frac{13000}{10000}$ is

$\frac{13}{1000}$: that is, $\frac{139}{1000}$

is equal to $\frac{139}{1000}$, and

$\frac{13}{100}$ to $\frac{13000}{10000}$, in their lowest Terms.

39) 2700000 (.6923

.....

360

90

120

30

2dly, Note for a General Rule; That you must always set off with a Point so many places of the Quotient for your Decimal, as the Number of Cyphers in the proposed Denominator, (according to the beginning of the last Sect.) And if there be not so many Figures in the Quotient, as there are Cyphers in the Denominator given, then that Number must be made up by putting Cyphers towards the left hand next the Point in the Quotient or Decimal.

3. Hence it follows, That to reduce Coin, Weight, Measure, &c. to the Decimals of an higher Denomination, may easily be done, by first repre-

representing them in Vulgar Fractions, and then reducing those Vulgar to Decimal, as above.

So to reduce $3\frac{1}{4}d.$ to the Decimal of a Pound, I consider that this is 13 Farthings, and that a Farthing is $\frac{1}{4}$ of a Pound: therefore 13 qrs. is $\frac{13}{4}$ of a Pound. So that

$$960. 13 :: 10000. .0135 = \text{the Decimal sought.}$$

Hereupon multiplying and dividing, I find the Quotient 135; but because there are 4 Cyphers in the Denominator (or 10000) given, therefore I must have 4 places towards the right hand of the Point for the Decimal, which 4th place I make up with a Cypher, as you see; and the Converse of this Proportion reduceth any Decimal to a Vulgar Fraction; or one Vulgar Fraction may be reduced to any other, whose Numerator or Denominator is given. For

$$135, \text{ \&cc. } 10000 :: 13. 960 \text{ or } 10000. 135, \text{ \&cc. } :: 960. 13$$

Or if you would reduce the given Vulgar Fraction to another whose Denominator is 12372, the Proportion holds thus:

$$960. 13 :: 12372. 167\frac{5}{7}\frac{1}{2}\frac{6}{7}$$

So that $\frac{167\frac{5}{7}\frac{1}{2}\frac{6}{7}}{12372}$ is near equal to $\frac{13}{960}$ or .0135

Which may suffice to shew how to reduce any one Fraction to another, and consequently a Vulgar to another whose Denominator is 10, 100, &c. i. e. any Vulgar to a Decimal.

And this puts me in mind of a new kind of Decimal that might be contrived, which would not only admit of being expressed in one Line as the common Decimal; but whereas that Decimal saves much of Division (which is its Excellency) so this new one would save much trouble of Multiplication: and that is, by reducing all Vulgar Fractions to one whose Numerator is 10, 100, 1000, &c. And the Numerator might be shewn, by pointing over the Figure in the Denominator, where the 1 or place next the left hand of the Numerator would fall: thus $\frac{10}{1472}$ is wrote 1472: $\frac{100}{1472}$ is 1472; and $\frac{1000}{1472}$ 1472 But I shall leave this Notion to be improved by the Ingenious, if thought worth their while; and beg the Reader's pardon for this *small* Digression, which there is not room in this Book to enlarge on.

	qrs. lb.				Decimals required.
1. In Averdupoize	3 : 20,	is $\frac{104}{112}$ C.	And	112. 104 :: 10000.	.9285
	18,	is $\frac{18}{112}$ C.	And	112. 18 :: 10000.	.1607

$\frac{3}{4}$. dw. gr.
 2. In Troy Weight 11 : 12 : 10, is $\frac{5578}{5776}$. And 5760. 5578 :: 10000. .9684
 Gal. Pint.
 3. In Liquid Measure 1 : 3 : is $\frac{1}{3}$. And 288. 11 :: 10000. .0382
 this Vulg. Fraction of a Beer-Barrel $\frac{1}{3}$.
 4. In Dry Measure 1 Pint is $\frac{1}{512}$ of a Qr. And 512. 1 :: 10000. .0019
 5. In long Measure 1 Yard is $\frac{1}{1760}$ of a Mile: And 1760. 1 :: 100000. .00056

And thus I have fully shewed the Fundamentals of making Decimals. I shall proceed in the third place,

Note, That .9 of any lowest Denomination, or .999 of an highest, may be taken for a Unit, as in the last of the 3 first Examples following, &c.

To find the Values (as in these Examples) you must multiply as in the 2d, 4th, 6th, and 8th Columns.

Value.	Decimals	Value.	Decimals	Value.	Decimals	Value.	Decimals of a
of a L. Sterl. as		of 1 Cwt. as		of 1 lb. Troy, as		Barrel Beer, as	
.0135 by 20 s.		.9285 by 4 qrs		.9684 by 12		.0382 by 4	
.2700 by 12 d.	Qrs 3	.7140 by 7 l.	3 11	.6208 by 20		.1528 Firk. by 9 Gal.	
Pen. 3 .2400 by 4 qrs	4	.9980 by 4 l.	dw. 12	.4160 by 6	Gal. 1	.3752 8 Pints.	
.9600	lb 19 or 20 Pound	.9920	2	.4960 by 4	Pints 3	.0016	
or 1 Farth.			grs 9 or 10	.9840			
1	2	3	4	5	6	7	8

And cut off as many Places from the right hand of each Product, as there are in the Decimal given. These prove the Examples above of the same Denominations.

Note, That in the 2d Example I multiply .7140 by 7, and that Product by 4, instead of multiplying .7140 by 28, the Pounds in a Quarter of an Hundred. And in the 3d Example, because I cannot multiply .4160 by 24, as by 1 Figure, therefore I first multiply it by 6, and that Product by 4; which Methods produce the same thing as multiplying .7140 by 28, and .4160 by 24, only there is Addition saved in each Example.

IV. A second Way to find the Decimal of any thing, deduced from the four last Examples.

From a due Consideration of the last Examples, you may by a direct contrary way of Operation find the Decimals of any Denomination, here dividing, whereas there you multiplied. For instance,

Di- vide by	To reduce to a De- cimal of a Pound.	Quotients or Answers.	Di- vide by	To reduce to a De- cimal of 1 C.	Quotients or Answers.	Di- vide by	To reduce to a De- cimal of l. Troy.	Quotients or Answers.
	l. 0	.0135416 r 1 = 3d qu.		C. 0	.92857 = 3d qu.		l. 1	.9684 = 4 quo.
20	s. 0	.27083 r 1 = 2d quo.	4	qrs 3	.71428 = 2d qu.	12	3 11	.62083 r 1 = 3q.
12	Pence 3	.25 = 1st quote.	7	5	= 1st quote.	20	dw. 12	.416 r 1 = 2d q.
4	Farth 1		4	lb 20		6	2	.5 = 1st quote
						4	gr. 10	

1. Having put down your Denominations that you would reduce into the Decimal of an higher, as you see in these Examples, begin at the lowest to divide by the proper Divisor for reducing into the next superior Denomination, putting, or imagining, Cyphers to stand in the Decimal places toward the right hand. But,
2. You will observe from these Examples, that the mixt Numbers, as 3.25 Pence, 3.7428 Quarters of a C. are the Dividends, and that the Decimals are the Quotients: Thus I first divide 1 Farthing or 1.00 by 4, and put the Quote to the right hand of the 3 Pence for the Decimal of a Penny; then I divide 3.25 by 12, &c. But,
3. In the second Example, instead of dividing lb 20 by 28, I divide it at twice by 4, and that Quote by 7; and also in the third Example, instead of dividing by 24 Grains, I (in this Case putting down

down only the Quotient, and doing the rest mentally) divide by the Digits 4 and 6, which amounts to the same thing.

V. Some brief Ways of Reduction of Decimals.

There are in many Instances much shorter Ways both of making Decimals and of finding their Value.

1. As to the first, any even Number of Shillings under 20 are reduced to the Decimal of a Pound, by taking half thereof; and thus you see in the Margin.

The Decimal of 6 s. is .3 l.

12 ——.6.

14 ——.7.

18 ——.9.

2. Any odd Number of Shillings under 20 are made Decimals of a Pound by putting a Cypher towards the right, and then taking the half, as in the Margin.

s. l.

3.0 = .15

9.0 = .45

13.0 = .65

17.0 = .85

3. From hence it is plain, that any Number of Shillings may have their Decimals put down as soon as named, by taking half the even Number; and for the 1 s. (in an odd Number) you see that it is always 5 in the 2d place from the Point.

4. To put any Pence and Farthings down in the Decimal of a Pound, consider what Farthings they make, and put them down in the 2d and 3d places from the Point: But after the Farthings are 24 or more, add 1 to the third place in the Decimal. And thus 19 s. 7 d. $\frac{3}{4}$ is put down in a Decimal immediately .982; for the 19 s. is .95, and the $7\frac{3}{4}$ is 31 Farthings, more 1 because 1 must be added at every 24, is 32; which added to the 2d and 3d places from the Point in .95, the Sum is .982. And,

5. If you desire to be so exact to have a 4th place from the Point, you may make the Figure in the 4th place 1 more than a 3d of what Farthings are in the Farthings given, when they do not exceed 23. As in the 3d Example of the 4 in the Margin, for 16 s. I put 8; for 9 d. $\frac{1}{2}$ or 38 Farthings I put 39 in the 2d and 3d places, because 38 is 13 above 25. Then for the 3d place I take $\frac{1}{3}$ of 13, which is 4; to which I add 1, and the Sum is 5 for the 4th place from the Point.

May be put

s. d. in Decimals.

8 : 4 $\frac{1}{2}$ ——.4187

13 : 2 $\frac{1}{4}$ ——.6594

16 : 9 $\frac{1}{2}$ ——.8395

19 : 11 $\frac{3}{4}$ ——.9989

So also in the 4th Example for the 19 s. I put .95, for the 6 d. of the $11\frac{3}{4}$, I put 25, (that is, 1 added at 6 d.) lastly, for the 5 d. $\frac{3}{4}$ (the rest of the $11\frac{3}{4}$, or 23 qrs.) I put $\frac{2}{3}$ of 24, more 1.

For *note*, That when the Farthings given are under, or so much as they are more than 24, you must take a third part of that Sum they are next to, which can be divided without a Remainder; as in the last, I take $\frac{1}{3}$ of 24, because 23 is nearer 24 than it is to 21.

And thus the Decimal of a Pound may be wrote to 4 places at once, or mentally computed, in a fifth part of the time it can be found by the nearer of the Ways above, and that near enough the Truth, unless it be required to be multiplied, as is before mentioned, and as in the Table at the beginning of Division.

6. *The Value also of any Decimal of a Pound may be found by Inspection: For if the place next the Point be doubled, it gives the Shillings, to which add 1 s. so often as the 2d place is 5 or more, for the reason under the 2d Rule above; then call what is under 5 (or more than 5) in the 2d place so many Tens of Farthings, and the Digit in the 3d place so many Units; and as often as they are 25, make them less by 1.*

<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>q.</i>
.912	=	18	: 2 : $3\frac{1}{2}$
.123	=	2	: $5\frac{1}{2}$
.754	=	15	: 1
.8766	=	17	: $6\frac{3}{4}$
.9877	=	19	: 9

Or more accurately thus; tho the Rule above may be thought near enough, as not erring a Farthing:

If the Farthings under or above 5 in the 2d place from the Point, and those in the 3d place be

{	6, and under 19, deduct $\frac{1}{2}$ a Farthing.
	19, ————— 33, ————— 1
	33, ————— 45, ————— $1\frac{1}{2}$
	45 and upward ————— 2

And so often as the 4th place is 6 or more, you may add half a Farthing.

And after this manner you may read Decimals in Shillings, Pence, &c. as fast as if they were wrote so; as I have examined many a thousand, having the Species read to me looking on the Decimals, which if continued to ever so many places, they alter not the Rules above.

Note, That these Allowances or Deductions are made because the Rule supposeth 1000 Farthings in a Pound *Sterling*, whereas there are but 960; therefore if 1000 Farthings is 40 more than the Truth, 500 is 20 more, 250 is 10, or 25 is 1 too much. And it is sufficient if done to a Farthing, which Decimals may be valued without regarding the 4th place.

7. *To find the Value of the Decimal of a Foot in Length by Inspection.*

Rule. For every 10th of a Foot reckon as many Inches and as many Quarters, under .5, (which is known 6 Inches.) 2dly, For every 2 in the 2d place add 1 quarter of an Inch. And this will not err a quarter

quarter of an Inch in the generality of Decimals, if in any.

Here in the 2d Example	In. qr.	Foot. Inch. qr.	} Examples.
.2 according to the Rule is	2 : 2	.37 = 4 : 2	
and .08 is half so many qrs. =	1 : —	.28 = 3 : 2	
	—	.73 = 8 : 3	
Sum =	3 : 2	.92 = 11 : 1	

And in the 4th Example,

.9 : .5 I say is	6 : —
.4 is 4 inch. 4 qr. or	5 : —
.02 is	— : 1
Sum =	11 : 1

Note, That in adding half, in the 2ds place, if odd, you may omit the odd, and take half the next lesser even Number, as in .07 and .03 I take only 3 qrs. and 1.

The immediate writing down any Inches and Quarters in the Decimal of a Foot is done so easily by the Rule above inverted, that there is no occasion for Examples.

8. To find the Value of the Decimal of a Gallon by Inspection.

Rule.] Multiply the Digit in the Primes place of the Decimal by 8, and the Digit next the left hand of the 2 Digits in the Product is so many Pints; then add the Di-

Gall. Pints. qrs.	Gall. Pints. qrs.	Gall. Pints. qrs.
.19 = 1 : 2	.64 = 5 : —	.34 = 2 : 3
.28 = 2 : 1	.73 = 5 : 3	.71 = 5 : 2
.37 = 3 : —	.82 = 6 : 2	.66 = 5 : 1
.46 = 3 : 3	.91 = 7 : 1	.88 = 7 : —
.55 = 4 : 2	.11 = — : 3	.99 = 8 : —

git next the right hand of the Product to that in the 2ds place of the Decimal given, and multiply that Sum by 4, and the place next the left hand of the Product are Quarters of Pints. Which is done with about a third of the trouble in the common way; and gives the Answer accurately enough.

Thus in .66, 8 times 6 is 48, the 4 are Pints, and the 8 of the Product added to 6 in the 2ds place is 14; 4 times 14 is 56; the 5 are Quarters of Pints or $1\frac{1}{4}$ Pints, which with the 4 is $5\frac{1}{4}$ Pints, &c.

9. To

9. To find the Value of the Decimal of a Barrel of Beer very briefly, and accurately.

Rule.] Multiply the given Decimal by 4, cut off from the Product 1 less than the Decimal places given; then subtract every Digit in the Product from its right hand Digit, and the Remainder is the Value sought in Gallons and Parts. Thus

in the 3d Example, the Product of .9876 by 4 is 39.504 (cutting but 3 off, according to the Rule:)

Then I begin with 4, and

take that from (0) which I suppose next it towards the right hand, that is, from 10, rests 6; 1 borrow'd and 0 (in Tens place) is 1 from 4 (in Units place) there rests 3; 5 from 10 rests 5; 1 borrow'd and 9 is 10 from 15 rests 5; 1 borrow'd and 3 (next the left hand, Column 2.) is 4, from 9 rests 5, and 0 from the said 3 rests 3; which said Rests are the Answers in Column 3, viz. 35.5536.

10. The 2 short Rules above being observed, the Decimal of a Barrel is found in Gallons, Pints, and Quarters of a Pint, very concisely thus:

Example 1.

Barrels Beer .19765

7.9060

Rests Gallons 7.11540

Pints 0 : 3.6 { Quarters of a
Pint and Parts. }

Example 2.

Barrels Beer .8764

35.056

Rests Gallons 31.5504

Pints = 4 : 2 quarters Pints.

I have contrived these 2 last for the Use of his Majesty's Officers of Excise, where they may almost by Inspection see the Value of the Decimal of a Barrel, to the 10th part of a Pint.

11. A most concise and easy Way to find the Value of the Decimal of a Pound Averdupoise Weight exactly.

Rule 1.] This may be done by this Rule: Multiply the Decimal given by 3, and cut off the Product 2 places fewer than are in the Decimal given; from that Product subtract a 7th of it self; then take a 16 of the Remainder, (which you may do, only putting down

down the Quotient, which are Ounces ; and the Remainder (less 1) are Drams, *per* this Example.

2. But the Rule to be insisted upon as more brief and accurate, is this : Multiply the given Number by 8, and double the Product of every 2 Digits as you go on, and the Product is Ounces and Parts. Then multiply in like manner the Parts of an Ounce, and the Product is Drams and Parts.

$$\begin{array}{r} .924 \\ \hline 277.2 \\ 39.6 \\ \hline 237.6 \\ \hline 314 : 12 \text{ dr.} \end{array}$$

Example 1.

Given = lb .924

Answer { Ounces = 14.784
Drams = 12.544

Example 2.

lb .567

Oun. = 9.072
Dr. = 1.152

Example 3.

lb .234

Oun. = 3.744
Dr. = 11.904

Or if it be thought burdensome to the Memory to multiply by 8; &c. as *per* the Rule above, it will be more easily done thus :

Rule 3.] Multiply the Decimal given by 6, and after you have added the Tens carried (as usual) add thereto the Digit next towards the right hand of that which you last multiplied, and put down what is above 10 (as commonly :) But when you have multiplied the Digit next the left hand, add the Tens carried to that Digit. For instance, in the first Example above say 6 times 4 is 24, put down 4, and carry 2 ; 6 times 2 (the next Digit) is 12, and 2 carry'd is 14, and the 4 in Units place is 18, put down the 8, and carry 1 ; 6 times 9 is 54, and 1 carry'd is 55, and 2 (the middle Digit) is 57 ; put down 7, and add the 5 carry'd to the 9 last multiplied, and that makes 14 : which I take to be the most concise and easy Method that this thing is capable of, unless as by the following

Rule 4.] Take the Primes place for so many Ounces; Halfs and Tenths of an Ounce ; Seconds place for so many 2.5 Drams ; and Thirds place for so many Quarters of a Dram.

Example. In .924 lb. .9 is 9 Ounces, 9 Halfs, and .9 = Oun. 14 : 6 Drams. 2 in Seconds place is 2 times 2.5 or 5 Drams ; and 4 in Thirds place is 1 Dram = 14 Oun. 12 Dr.

12. The most easy and short Way of finding the Value of a Decimal of 1 lb Troy Weight in $\frac{2}{3}$, dw. and grs.

1st, Multiply the Decimal given by 2, and add what is carry'd, and the Digit next the right hand (as in the third Rule) gives the Ounces.

2dly, Twice Primes place in the next Decimal of Ounces is so many Penny-weight; and every 5 in the Seconds place is 1 more.

3dly,

3^{dly}, What the Seconds place is under or above 5, and the Thirds place; take half thereof for Grains. But if they are 25 or upward, deduct 1; if 38 or upward, deduct 2. And if the Digit in Thirds place be an odd one, you may deduct only the odd one at 25, and 1 and the odd one at 38, &c.

Examples. \mathbb{Z} . dw. gr.

lb .5642 or 6 : 15 : 10

\mathbb{Z} 6.7704 do this by Inspection.

lb .9782 or 11 : 14 : 18 | dw. gr.

\mathbb{Z} 11.7384 by Inspection is 14 : 18

SECT. III. Addition of Decimals.

THIS Rule has no more difficulty than that of one Denomination in whole Numbers : observing,

1. To place the Decimal Places next the Point, or the several Places next the left hand, and the Points themselves, &c. one under another, as in the Examples.

2. If the Decimals to be added exceed not 5 in number, it is sufficient if they consist of 5 places where the Sum is not to be multiplied by any thing; but where it is to be multiplied, you must observe the Rules given in the beginning of Division, Sect. 6. of this Chapter. And if Decimals of a Pound Troy are to be added, the Decimals to be added ought to consist of at least 6 places : But if the Decimals be compleat, 'tis no matter how few the places be.

Example 1.

.925.
.0775.
.5.
.25.
.75.
.05.
.125.
Sum 2.6775.

Example 2.

Decimals of a Pound Sterl.	Value in Specie.
.9. ———	18 s. — d.
.05. ———	1 : —
.125. ———	2 : 6
.75. ———	15 : —
.775. ———	15 : 6
.65. ———	13 : —
.825. ———	16 : 6
.15. ———	3 : —
Sum 4.225. =	l. 4 : 4 : 6

Sum Proof.

3. Bu

3. But because the Decimals that occur in Practice are generally, if not always promiscuous, that is, neither all compleat Decimals, nor infinite, (certain or uncertain) therefore Examples of such mixt will be the most useful.

<i>Example 3.</i> <i>Of a mixt Number.</i>	<i>Example 4.</i> <i>Promiscuous Decimals.</i>	<i>Example 5.</i> <i>Promiscuous Decimals,</i> <i>&c.</i>
198765.	.17565	
19876.5.	.6 r	.9666666
1987.65.	.72939	.12345
198.765.	.5.	7.6777777
19.8765.	.17234	4.00276
1.98765.	.97548	.9879879
	.9 r	.12729
<hr/> Sum 220849.77915.	.87654	.9.
	.25.	<hr/>
	.09842	14.78593 Sum.
		or 14.7859324 r 3
	Sum=5.44447	
	or =5.444486 r 1	

By the 3 first Examples you see how easy the Addition of Decimals is, when placed as they ought to be, and so many are cut off for Decimals in the Sum, as are the greatest Number of places of those given; which is sufficient for the understanding of this Rule.

But because some have made a difficulty where there was none, by talking much of repeating Numbers; I have given the two last Examples, to shew that the common Method is accurate enough, without taking notice of repeating Digits as differing from others.

In Example 4. there being 2 Decimals consisting of repeating Digits, I put down only those next the Point, and sum up them, ist saying 9 and 6 is 15, and 1 carry'd (supposing the 9 and 6 which repeat were placed 2 places more to the right hand than 5 places, the greatest Number given) is 6: which I put down as you see in the lowest Line, and say 1 and 2 is 3, and 4 is 7, and 8 is 15, and 4 is 19, and 9 is 28, and 5 is 33, and (coming downward again, at every Series you add upward, with the repeating Digits) 6 is 39, and 9 is 48; put down 8, and carry 4 to the next Series, which makes it 29, and the 6 and 9 repeating is 44; put down 4, and carry 4 to the third Series, which makes it 39, and the 6 and 9 Repeaters is 54; put down 4, and so proceed in like manner to the Digits next the Points, where the 6 and 9 are added in course, as being there placed; so the Sum

U
is

is $5.444486\bar{7}$. And if you had filled only 5 places each with the 2 Digits that repeat, and had added them as the 3 former Examples, the Sum would have been the same, wanting only $.000016$, which supposing even the Decimal of a Pound Troy, is less than a 10th of a Grain. And in the 5th Example the difference between the Sums having regard to the repeated Digits, and the Sum the common way is so inconsiderable, as appears by the 2 Sums; not worth notice, if the 2d Rule of this Section be observed.

I have demonstrated in the 2d Example, by the Addition of the Specie answering the Decimals, that the Rules for adding Decimals are right: I shall here shew that the Rule for adding these is agreeable to that for Vulgar Fractions. For example, in adding $\frac{365}{10000}$ to $\frac{96}{1000}$, the common Denominator is 100000, the Numerators 36500 and 96000, the Sum of which is 132500; so the Answer, cutting off the Cyphers as useless, is $\frac{1325}{10000}$: and dividing the Numerator by the Denominator, that is, cutting off 3 Figures, the Answer is 1.325: But the superfluous trouble of putting down the Cyphers being omitted, the Work of Addition of Decimals is as above, and as per Margin.

$$\begin{array}{r} .365 \\ .96 \\ \hline 1.325 \end{array}$$

SECT. IV. Subtraction of Decimals.

THERE is no difference between the Method of this and Intire Numbers, observing to place the Point of the Subtrahend exactly under that of the greater Decimal. Two or three Examples will suffice to shew it.

Example 1.
From .9876.
Take .87654321

Example 2.
From 98.76
Take .08765

Example 3.
From 9876.
Take = .1234

.11105679 Remains = 98.67235 Remains = 9875.8766

Example 4.
From 123.45
Take 97.

Rests = 26.45

Example 5.

From l. 1.0976 or from 1 : 1 : 8.9856
Take = .987 or take — : 15 : 12.672

Difference .1106 or = — : 1 : 12.3136
The

Averdupoize Weight.
lb. Oun. Drms.

The Reason of the Work of Subtraction of Decimals is the same as is said of Addition, only subtracting instead of adding the Numerators; agreeing exactly with the Deduction of Vulgar Fractions, in which Method if the Cyphers be neglected in the Results, the Method falls just into that of Subtraction of Decimals, where the cutting off from the Sums, Remainders, Products, &c. is the same as dividing by a Unit with Cyphers (which is the Nature of the Denominators of Decimals) as is shewed in Division of Intire Numbers.

SECT. V. *Multiplication of Decimals.*

THERE is no difference between the Operations here and by Integers, but observe this Rule:

After the Work is over, you must set off so many Figures towards the right hand of the Product, as you have Decimals in both the Factors.

But if so many places are not in the Product (as it will happen when you multiply Decimals of small Value) then you must make up that Number by placing Cyphers towards the left hand of the Product next the Point.

Example 1.
A Decimal by an Integer.

$$\begin{array}{r} .012345. \\ 932 \\ \hline 24690 \\ 37035 \\ 111105 \\ \hline 11.505540 \end{array}$$

Example 2.
A mixt by a mixt Number.

$$\begin{array}{r} 9.37241. \\ 25.324. \\ \hline 3748964 \\ 1874482 \\ 2811723 \\ 4686205 \\ 1874482 \\ \hline 237.34691084 \end{array}$$

Example 3.
A mixt Number by a Decimal.

$$\begin{array}{r} 36.252. \\ .00032. \\ \hline 72504 \\ 108756 \\ \hline .01160064 \end{array}$$

Example 4.
A Decimal by a Decimal.

$$\begin{array}{r} .1256471 \\ .00009 \\ \hline .000011307971 \end{array}$$

Note, That in the fourth Example, because the 4 is repeated *ad infinitum*, therefore I say, 9 times 4 is 36, and 3 (which would be carry'd if you actually put down another 4) is 39; put down 9, and carry 3.

U 2

Now

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Now if you had put down and multiplied 100 Fours of those repeated, so many Nines would also be repeated in the Product; but for brevity-sake I only put down one of each with an *r*.

To multiply mixt Numbers, Decimals, &c. and to have only so many Decimals in the Product as you assign: And how to avoid all unnecessary Figures in such Operations.

Case 1. A mixt Number by a mixt, as 1.234504 by 9.2123. and to have only 4 Decimals in the Product.

$$\begin{array}{r} 1.234504 \\ 9.2123. = \text{the Multiplier inverted.} \end{array}$$

$$\begin{array}{r} 111105 \\ 2469 \\ 123 \\ 25 \\ 4 \end{array}$$

11.3726 = the Product.

Case 2. A Decimal by a whole Number, as .1234504 by 92123, and to have 3 places in the Product Decimals.

$$\begin{array}{r} .1234504 \\ 92129 = \text{the Multiplier inverted.} \end{array}$$

$$\begin{array}{r} 11110536 \\ 246901 \\ 12345 \\ 2469 \\ 370 \end{array}$$

11372.621 = the Product.

Case 3. A Decimal by a Decimal, and to have only 4 Decimal places in the Product; as .12345 by .92123

$$\begin{array}{r} .12345 \\ .92129. = \text{the Multiplier inverted.} \end{array}$$

$$\begin{array}{r} 1111 \\ 25 \\ 1 \end{array}$$

.1137 = Product required.

1. To perform these Operations, 'tis plain that the Multiplier is inverted, and Units place put next the left hand, &c. when you place it down to multiply.

2. The due placing of it is the next thing, which is to put Units place of the intire part under that place in the Decimals of the Multiplicand, which answers that place next the right hand of the Decimals you would have in the Product: As in the first Example, because I would have 4 places Decimal in the Product, therefore I put 9 (the Units given) under the 4th place from the Point in the Multiplicand. And in the 2d Example, I put 3 (the Units place of the Multiplier given) under the 3d Decimal of the Multiplicand; and in the 3d Example, because I would have 4 Decimals in the Product, I put the Digit next the Point in the Multiplier under the 3d place of the Multiplicand, because there is no intire Number to put under the 4th place; and place all the other Figures of the Multipliers in a reverse Order, as *per* the Example.

3. Begin to multiply the Figure next the right hand of the Multiplier, when placed as *per* Rules above, into the Figure standing over it, &c. as in the common way; observing at the same time what Tens would be carry'd if you multiplied the next Figure or two toward the right hand, and adding such Tens and half Tens or upward as Ten, and so proceed with each Figure in the Multiplier that hath another standing over it, (omitting the rest) and place the 1st Product of each Figure, *viz.* what the same is above ten or tens Units, under the Units of the first Line, &c. and not as in common Multiplication; which Lines add up, and the Aggregate is the Product required. The 3 Examples above make it plain, and that much Trouble and many superfluous Figures are prevented.

Case 4. *But it may sometimes happen,* That, as in the following Example, so many places are not in the Sum as you proposed for Decimals: in which case add 1 or more Cyphers.

Thus to multiply .12345 by .234, see the Work in the Margin, to have 4 Decimal places in the Product; where the making of 13 Digits are saved.

Case 5. *Also it may happen,* That there are not so many Decimal places in the Multiplicand as you propose shall be in the Multiplier; so that you cannot proceed as *per* Rule 2. above: in this Case you may sup-

$$\begin{array}{r}
 .12345. \\
 432. \\
 \hline
 247 \\
 37 \\
 5 \\
 \hline
 .0289 = \text{Product}
 \end{array}$$

ply.

ply the place by Points; thus, to multiply 32.34 by 7.93245 see the Work in the Margin, to bring out 4 places Decimal.

These are all the Variety I could think of as to this matter, which are mostly not extant before that I know of: And the following Compendiums are intirely my own Contrivance; and if any of them are extant, I can assure the Reader I borrow'd nothing therefrom.

$$\begin{array}{r}
 32.34. \\
 54239.7 \\
 \hline
 22638. \\
 29106. \\
 9702 \\
 647 \\
 129 \\
 16 \\
 \hline
 256.5354
 \end{array}$$

New COMPENDIUMS in Multiplication.

1. To multiply by any Factor under 20 at once.

Example
$$\begin{array}{r}
 3.4567 \\
 \text{by } .19. \\
 \hline
 \end{array}$$

.656773 Product.

The common Way
$$\begin{array}{r}
 3.4567. \\
 .19. \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 311103 \\
 34567 \\
 \hline
 \end{array}$$

The Probation .656773

2. To multiply by any Factor between 100 and 110 (exclusive) at once.

Example
$$\begin{array}{r}
 34567 \\
 .108 \\
 \hline
 \end{array}$$

3733.236 Product.

The common Way
$$\begin{array}{r}
 34567 \\
 .108 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 276536 \\
 34567 \\
 \hline
 \end{array}$$

Prob. = 3733.236

3. To multiply by any Factor between 111 and 119 (inclusive) at once.

Example
$$\begin{array}{r}
 .34567 \\
 11.7. \\
 \hline
 \end{array}$$

4.044339 Product.

The common Way
$$\begin{array}{r}
 .34567 \\
 11.7. \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 241969 \\
 34567 \\
 34567 \\
 \hline
 \end{array}$$

Prob. = 4.044339

4. To

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4. To multiply by any Number between 1111 and 1119 (inclusive) at once.

Example
$$\begin{array}{r} 34567 \\ 11.14. \\ \hline \end{array}$$

$385076.38 = \text{Product.}$

The common Way
$$\begin{array}{r} 34567 \\ 11.14. \\ \hline 138268 \\ 34567. \\ 34567 \\ 34567 \\ \hline \end{array}$$

Prob. $= 385076.38$

5. To multiply by a Factor between 11111 and 11119 (inclusive), putting only the Product.

Example
$$\begin{array}{r} 34567 \\ 111.16. \\ \hline \end{array}$$

$3842467.72 = \text{Product.}$

The common Way
$$\begin{array}{r} 34567 \\ 111.16. \\ \hline 207402. \\ 34567 \\ 34567 \\ 34567 \\ 34567 \\ \hline \end{array}$$

Prob. $= 3842467.72$

6. To multiply by a Factor between 20 and 100 exclusive.

Example
$$\begin{array}{r} 3.4567. \\ 65 \\ \hline \end{array}$$

$224.6855 = \text{Product.}$

The common Way
$$\begin{array}{r} 3.4567. \\ \text{by } 65. \\ \hline 172835. \\ 207402 \\ \hline \end{array}$$

Prob. $= 224.6855$

7. To multiply by a Factor consisting of a Cypher between two Digits.

Example
$$\begin{array}{r} .34567 \\ 605 \\ \hline \end{array}$$

$209.13035 = \text{Product.}$

The common Way
$$\begin{array}{r} .34567. \\ 605. \\ \hline 172835. \\ 207402 \\ \hline \end{array}$$

Prob. $= 209.13035$
8. To

8. To multiply by a Factor consisting of 2, &c. Cyphers between two Digits.

Example 34567
 6005

Product = 207574835

The common Way 34567
 6005

 172835
 207402

Prob. = 207574835

9. To multiply by a Factor consisting of so many Cyphers between two Digits, as there are Places in the Multiplicand.

 34567
 6000005

Product = 207402172835

10. To multiply by any Factor between 100 and 200 ; only putting down the Product.

Example 23456
 154

Product = 3612224

The common Way 23456
 154

 93824
 117280
 23456

Prob. = 3612224

11. To multiply by a Factor consisting of a Unit between any 2 Digits.

Example 23456
 416

Product = 9757696

The common Way = 23456
 416

 140736
 23456
 93824

Prob. = 9757696

Thus far by only putting down the Figures of the Product.

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12. From what is above, it is plain that any Number may be multiplied by a Factor, being the Square of any in the Propositions above, or the Rectangle of any two of them, by only making 1 Line besides the Product. For knowing that 1235 is the Product of 65 by 19, multiply for example 34567 by 19 (as per Case 1.) produceth 656773; and that by 65 (as per Case 6.) produceth 42690245, the same as 34567. by 1235.

Examp. 1.

34567
19
656773
65
42690245

Examp. 2.

34567
11116
384246772
6005
42690245

Prod.=2307401865860

or 34567
by 66751580

276536
172835
34567
172835

Examp. 2. 241969
proved. 207402
207402

Proof = 2307401865860

The Factor 66751580 being the Rectangle of the 2 towards the left hand; therefore 34567 is multiplied by 66751580, by only making 9 Figures besides the Product; which is 32 fewer than must be put down and added in the common way.

13. Or if a Factor or Multiplier consist of the Figures in any two of the former Digits, &c. put down in course; the same may be performed as follows:

12.3456732.
111166005

741357675660 = the multipl. by 6005.
1372345032912 = the multiplied by 11116.

= 1372419168.6795660 = Product.

The common Way 12.3456732.
111166005

617283660
740740392
740740392
123456732
123456732
123456732

Proof = 1372419168.6795660

By this Method there are put down and added 38 Figures fewer than in the common way.

See also the Proof of the last Example in the Book save one, where 9 Places are multiplied by, and only 5 Lines made.

X
14. To

14. To multiply by a whole Number consisting of any Digit repeated any number of times, as suppose by 7 repeated 8 times.

$$\begin{array}{r}
 12345678932 \\
 77777777 \\
 \hline
 86419752524 \\
 \dots\dots\dots \\
 \hline
 960219462886694164 \text{ Product.}
 \end{array}$$

Note, This Invention is so much shorter than the common Way, that in this Example there are 77 Figures fewer.

Common Way

$$\begin{array}{r}
 1234.5678932. \\
 77777777 \\
 \hline
 86419752524 \\
 86419752524 \\
 86419752524 \\
 86419752524 \\
 86419752524 \\
 86419752524 \\
 86419752524 \\
 86419752524 \\
 86419752524 \\
 \hline
 \text{Proof} = 960219462886694164
 \end{array}$$

15. To multiply by a Decimal consisting of any Digit repeated *ad infinitum*, very easily, briefly, and accurately.

Note, This is done with 84 Figures fewer than the common Way, and is about 100 nearer the Truth.

In this Case cut one place more from the Product than the Decimal Places in the Multiplicand, for Decimals of the Product; or so many more than one as there are Cyphers before the repeated Digit of the Multiplier.

$$\begin{array}{r}
 12345678932 \\
 .77777777, \&c. \\
 \hline
 86419752524.
 \end{array}$$

Product 9602194724.8r1

16. To multiply by a mixt. Number, consisting of any Number of Digits repeated.

Example.

$$\begin{array}{r}
 \text{as } 12345678932 \\
 \text{by } = 7777.7777, \&c. \\
 \hline
 \text{by } 7 = 86419752524 \\
 \hline
 \text{Product} = 96021947248888.8r1
 \end{array}$$

For Proof of this.

$$\begin{array}{r}
 12345678932. \\
 \text{by } 7777. \\
 \hline
 = 96012345054164 \\
 \text{and by } .7, \&c. = 9602194724.8 \\
 \hline
 \text{Sum} = 96021947248888.8r1.
 \end{array}$$

Directions

Directions concerning the 16 Compendiums above.

As to *Compend. 1.*] It is performed as in common Multiplication by 9, only adding the Digit toward the right hand of every one that you multiply by the 9 ; and when you have multiplied the last in order, add what you carry to that Digit next the left hand, and that gives the 2 last in the Product.

Compend. 2.] Work as in the last, only with this difference, that you must add the 7 in Units place to the Product of 8 by 5, and the 6 to the Product of 8 and 4, &c. Lastly, add what you carry to the 4, is 7, and then put down the 3 next the left hand.

Compend. 3.] When there is 1 in Units and 1 in Tens place, besides a place Decimal, or 114, 116, 117, &c. you must add to each Product of every Digit multiplied by 7, the 2 next Digits standing towards the right hand, when there are so many. As to the Product of 6 by 7, I add the 7 next the 6 ; and then say, 7 times 5 is 35, and 5 carried is 40, and 6 is 46, and 7 is 53 ; put down 3, and carry 5, &c. Lastly, when you have multiplied the 3 by 7, and added the 4 and 5, add the 3 carried to the 3 and 4 is 10, and 1 carried and 3 is 4.

Compend. 4.] This is performed as the last, only adding 3 Figures (when you have so many) standing toward the right hand of every Digit which you multiply by the 4. And at last the 3 carried is added to 3, 4 and 5 is 15, and the 1 carried (the 5 being put in the Product) added to the 3 and 4 make 8, which put down, and the 3, as you see in the Example.

Compend. 5.] Whereas here you have 4 Units towards the left hand, you must add 4 Figures (when you have so many) standing towards the right hand of every Digit you multiply by 6. And what is carried must be added to the 4 places next the left hand of the Multiplicand at last, and then 3, and then 2, and then put the 3 in the Multiplicand down.

Compend. 6.] Say 5 times 7 is 35, 5 and carry 3 ; 5 times 6 is 30, and 3 is 33, and 6 times 7 makes 75 ; put down 5, and carry 7, and say 5 times 5 is 25, and 7 is 32, and 6 times 6 makes 68 ; put down 8, and carry 6, and say 5 times 4 is 20 and 6 is 26, and 6 times 5 makes 56 ; put down the 6 and carry 5, and say 5 times 3 is 15, and 5 carried is 20, and 6 times 4 makes 44 ; put down 4, and say 6 times 3 is 18, and 4 is 22.

Compend. 7.] In this Example, because there is a Cypher between, you must multiply the two first as usual, and to the Product of the 5 in the 3d add what is carried, and the Product of the 6 in the first or Units place of the Multiplicand. Then to the Product of 5 in the 4th add what is carried, and the Product of 6 in the 2d or 6, &c. and lastly multiply 4, then 3 by the 6, and put the Product down.

Compend. 8.] Multiply as usual to multiply the 4, then say 5 times 4 is 20, and 2 is 22, and 6 times the 7 is 64, 4 and carry 6; 5 times 3 is 15, and 6 is 21, and 6 times the 6 (or 36) makes 57; put down the 7, and multiply the 5, 4 and 3 by the 6, adding the 5 carried.

Compend. 9.] In this and the like Cases there is no more difficulty than in multiplying by a single Digit; for the Number of Cyphers being equal to the Places in the Multiplicand, the Product by the 6 falls just to the left hand of the Product by the 5. But if the Product of the Digit next the left hand by that in Units place, and what is carried, be less than 10, then a Cypher must be put down between the two Products.

Compend. 10.] This is performed by considering the Nature of the Operations of the first and sixth Compendiums. For 4 times 6 is 24, 4 and carry 2; 4 times 5 is 20, and 2 carried and 5 times 6 makes 52, 2 and carry 5; 4 times 4 is 16, and 5 is 21, and 5 times 5 is 46, and 6 in Units place makes 52, 2 and carry 5; 4 times 3 is 12, and 5 is 17, and 5 times 4 makes 37, and 5 (in Tens place of the Multiplicand) is 42, 2 and carry 4; 4 times 2 is 8, and 4 is 12, and 5 times 3 makes 27, and 4 (in Hundreds place) is 31; put down 1, and carry 3. Then (having multiplied all by the first Figure) I say 5 times 2 is 10, and 3 carried is 13, and 3 in Thousands place is 16; 1 time 2 is 2, and 1 carried is 3.

Compend. 11.] This is performed as the last, only instead of adding the Digit next the right hand, &c. to the Product of the second Figure in the Multiplier, you must here add it to the Product of the first Figure, because the 1 stands next that Digit; and then you keep to the 1st and 6th Compendiums, as in the last.

Compend. 12.] By this Compendium is shewn how to multiply by 66751580, or other large Number produced by the Multiplication of 2 or Square of one known Number, by only making 1 Line besides the Product. The Example is that of the 5th and 8th.

Compend. 13.] This is likewise an Example shewing how the Work of Multiplication by large Numbers may be shorten'd, by dividing

dividing such large Number into 2, 3, &c. such Numbers as fall within some of the abovesaid Rules: as 111166005 I divide into two Multipliers, 11116 and 6005, &c. done at twice.

Compend. 14.] This Compendium is performed, first, by multiplying the given Number by one of the repeated Digits, as in the Example above the Product is 86419752524, from which the general Product is found thus; Add that Product from the right hand toward the left, and say 4 and 2 is 6, and 5 is 11, (put down the 4, 6 and 1, and for every 10 you arrive at, put 1 to the Sum more than what is wrote down) and 1 is 12, and 2 is 14, and 5 is 19, and 7 is 26, put down the 4, 9 and 6; then adding 1 more for the 2d 10, I say, and 1 is 27, and 9 is 36, and 1 (for that 3d 10) is 37, and 1 next the 9 is 38; so I put down the 6 and 8.

Then because I have added as many places as are in the Multiplier, I leave out Units place (4) and add from 2 in Tens place to 4, the 3d Figure from the left hand inclusive, which with the 3 carried (part of the said 38) makes another 38; put down that 8, and carry 3, so adding that to 5, &c. to 6, the 2d Figure from the left hand (leaving out the 2 first Figures next the right hand) that Sum is 42; I put down the 2, and carry 4, adding that to 2, (the 4th from the right hand, leaving out the 524) and so forward to 8, next the left hand inclusive, the Sum is 46: I put down the 6, and add the 4 to the Figures between 5 and 8 inclusive, (leaving out the 2524) and the Sum is 44; I put down 4, and add 4 to the Figures between 7 and 8 inclusive, (leaving out the 52524, and so every time I leave out 1 more) as 4 and 7 is 11, and 9 is 20, &c. to 8 makes 39; put down the 9, and add 3 to 86419, as they stand from the right to left, as before, and the Sum is 31: put down 1, and add 3 to 8641, as taught before, and the Sum is 22; put down the 2, and add 2 to the 864 as aforesaid, and the Sum is 20; 0, and carry 2 and 6 is 8, and 8 is 16; put down 6, and say 1 and 8 is 9: so have you the Answer only by easy Additions.

Compend. 15.] If the repeated Figure be a Decimal for the Multiplier, I multiply as before to gain the 86419752524; whence the Product is found first by adding that whole Line from the right to the left hand, which makes 53: I add the 5 to the 3 is 8, which I put down for the repeating Digit of the Product. Then add the 5 carried to 2 (in Tens place) and that to the rest of the Line towards the left hand makes 54; put down the 4, and carry 5 to the 5, (in Hundreds place) &c. adding all toward the left hand as before, leaving out 1 toward the right for every Digit put in the Sum:

Sum : which is a most easy and brief Way of answering all Questions of that kind.

Compend. 16.] If the Multiplier be a repeated Digit and a mixt Number, you have nothing to do more than in the last Compendium : only to put so many of the repeated Digits towards the right hand of the integral part of the Product, as there are places in the integral part of the Multiplier, as in the Example 16. above.

A second Example of the 16th Compendium, to multiply 1234 by 333.3333333, &c. or 333.3 r. See the Operation.

Multiply 1234

by . . 333.33333333, &c.

3702

411333.3 r = Product.

Proved thus 1234

as per 15th by .3 .3 r

is = 411.3 r 1

and by 333 = 410922

Sum = Proof = 411333.3 r

In this (as the last) having multiplied the 1234 by 3, it produces 3702, which I add from the right hand towards the left, and the Sum is 12 ; so 2 and the 1 is 3 = the repeating Digit, and 1 carried added to 0, 7 and 3 is 11 : I put 1 down, and carry 1 and 7 is 8, and 3 is 11 ; put 1 down, and carry 1 to 3 makes 411.3 r ; and because there are 3 places Integers of the Multiplier, I therefore put 3 places of the repeating Figure towards the right hand of the 411, makes 411333.3 r the true Answer, as by the first Example and Rules for working the same under the last mentioned Compendium.

17. Or if it should be supposed (tho such a thing does not often happen) that the Decimal Digits repeat in both the Factors ; then work as under the 15th Compendium, and to that Result add the Product by the next, &c. Digits, putting down what would be carried if the Decimal Digit were really repeated.

Example. 3.6 r
4.3 r

Product = 110

Sum = 1.22 r }
Product = 14.6 r }

Sum = Answer = 15.8 r 1

Proof $3\frac{2}{3} = \frac{11}{3}$

$4\frac{1}{3} = \frac{13}{3}$

and $\frac{11}{3}$ by $\frac{13}{3} = \frac{143}{9} = 15.8 r 1$

18. But

Sect. 5. *Multiplication of Decimals.*

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18. But if the repeating Digits in both Factors begin after the Primes place, (altho the Case may rarely happen) you may proceed as in the following Example.

To multiply $27.16\overline{r1}$ by $5.23\overline{r1}$.

$27.1666666, \text{ \&c.}$

$5.23333333, \text{ \&c.}$

$.8150 = \text{Product by } .03 \text{ in } 27.16\overline{r1}$

$.905\overline{r1} = \text{Sum of the last Line, as per 15th, \&c. Compend.}$

$5.433\overline{r1} = 27.16\overline{r1} \text{ in } .2$

$135.833\overline{r1} = 27.16\overline{r1} \text{ in } 5$

$142.172\overline{r1} = \text{the true Product, or Sum of the three last Lines.}$

I need say no more to illustrate the last Example; and having now finished what I thought might be of real use in Operations of Multiplication, whether by Decimals or Integers; I shall not trouble my Reader with useless as well as troublesome and tedious Speculations. But for the Solution of all Questions in Practice, as of Concrete Numbers, I refer to the third Rule in the next Sect. (6.) for making your Decimal longer or shorter, as occasion requires, according to the Greatness of the Number by which such Decimal is to be multiplied: for which purpose a Table is there inserted, to direct on almost all Occasions.

These 18 Compendiums, as well as the 3 or 4 Cases preceding them, are new to me; tho I am since my writing them informed, that one or two of the first and most easy of these Compendiums are in Mr. *Lyburn's* Arithmetic: however that be, I have no reason to omit any, as being my own Contrivance.

These Operations, altho at first they may seem difficult, and to burthen the Memory; yet I can assure the Reader, that by Use they will become as easy as common Multiplication, (as I know by Experience) and that they very much abbreviate the Operations, cannot be deny'd: nay, many of these new Compendiums are not only shorter, but easier and more accurate than the common Way. And I doubt not but these, and those many in Reduction of Decimals, being new and great Improvements, will be accordingly received by the Ingenious.

That

That Multiplication of Decimals is done by the same Rule as Vulgar Fractions.

To instance in multiplying .126 by .74: According to the Rule of Vulgar Fractions, the Product of the Numerators is 9324, of the Denominators 100000, the new Fraction $\frac{9324}{100000}$ as a Vulgar; or as a Decimal, by the Rule in Notation, .09324, that is, 9324 being divided by 100000, quotes .09324.

$$\begin{array}{r} .126 \\ .74 \\ \hline 9324 \end{array} \begin{array}{l} \text{Numerators.} \\ \text{Product.} \end{array}$$

$$\begin{array}{r} \text{Denominators} \left\{ \begin{array}{l} 1000 \\ 100 \end{array} \right. \\ \hline \text{Product} = 100000 \end{array}$$

Hence appears wherein the Preference of the Decimal Fraction consists: As,

that is $\frac{9324}{100000}$ as Vulgar.
or .09324 as Decimal.

1. In the easy Multiplication of the Denominators, which is only putting the Cyphers of the one toward the right hand of the other.
2. In that the Decimal can be expressed without its Denominator. And,
3. In case of finding the Value of the Decimal Fraction, the dividing by the Denominator is done by Inspection, which in Vulgar Fractions often requires a tedious Operation, &c.

SECT. VI. Division of Decimals.

THIS Rule is the same, as to the Operation, with Division of Intire Numbers; but it must be observed,

1. To know how many Cyphers to add to the Dividend, that so the Quotient may have a competent Number of Decimal Places, take this

Rule. Consider how many Decimals will suffice to be in your Quotient, (upon the Foundation of the Rule of Decimals, as per the little Table following the next Rule) and add that Number to the Decimal Places in the Divisor, and then make the Decimal Places in the Dividend equal to that Sum, by putting Cyphers toward the right hand, if need be.

2. To know (when the Work of Division is ended) how many Places of the Quotient are Decimal.

Rule. The difference between the Decimal Places in the Dividend and Divisor, are the Decimal Places toward the right hand of the Quotient. But

But if so many Places be not in the Quote as the said difference is, you must make up that Number by prefixing Cyphers towards the left hand, as *per* the Rule in Reduction.

I could here give another Rule for this purpose, but it not being so intelligible and useful in all Cases, the inserting of it may only serve to hinder the Learner in his Progress: I therefore omit it.

A few Examples will enable the Reader to apply the Rules above, and fully to understand Division of Decimals; as in the 9 Cases following. But first observe,

3. The Number of Places in a Decimal sufficient, when to be multiplied as followeth.

In the Decimal of l. 1. Sterling.		In the Decimal of 1 Shilling.		In the Decimal of lb 1 Troy.		In the Decimal of lb Averd.		In the Decimal of 1 Barrel Beer.	
Places suffi- cient.	When to be multiplied by these or under.	Places suffi- cient.	When to be multiplied by these or under.	Pla- ces suffi- cient	When to be multiplied by these or under.	Pla- ces suffi- cient.	When to be multiplied by these or under.	Pla- ces suffi- cient.	When to be multiplied by these or under.
9	1000000	9	20000000	9	190000	9	4000000	9	3800000
8	100000	8	2000000	8	19000	8	400000	8	380000
7	10000	7	200000	7	1900	7	40000	7	38000
6	1000	6	20000	6	190	6	4000	6	3800
5	100	5	2000	5	19	5	400	5	380
4	10	4	200	4	1.9	4	40	4	38
3	1.0	3	20			3	4.0	3	3.8
		2	2.0						

Without lo-
sing a Unit
of the least
Denomina-
tion.

Vid. also
Case 5.
above.

I have inserted this Table, that you may not run your Decimal to more places than are absolutely necessary.

To apply the first and second Rules above.

Example 1. To divide a mixt Number by a mixt, as 237.34691084 by 25.324.

Examp. 2. To divide 11.50554 by 932, so that six places Decimal may be in the Product.

932)11.505540(.01245=Quote
.....
2185
3215
4194
4660
0

as per the 2
Rules above,
adding 1 Cy-
pher to the
Dividend.

25.324)237.34691084 (9.37241.

94309
183371
61030
103828
25324
0

Example 3. To divide .1234567 by .321, a Decimal by a Decimal, and to have seven Decimal places in the Quote.

Here, according to the first Rule above, to have 7 places in the Quotient, I must have 10 in the Dividend, which I make the other places up by adding three Cyphers.

2. According to the 2d Rule, I point off 7 Decimal places in the Quote, because that is the difference between those places in the Dividend and Divisor.

Example 4. To divide a Decimal by a whole Number, as

.463 by 3214, and to have 8 Decimal Places in the Quotient.

Example 5. To divide a whole by a mixt Number, so as to have 9 places in the Decimal Part of the Quote ; as 9 by 3.214.

3.214) 9.0000000000000000 (2.800248911
..... = the Quote

25720

8000

15720

28640

29280

3550

3260

46 refts.

.321) .1234567000 (.3846003
.....

2715

1476

1927

1000

37

3214) .46300000 (.00014405
.....

14160

13040

18400

2130

Example 6. To divide a whole Number by a whole, and to have 10 Decimal Places in the Quotient ; as 5 by 365.

Example 7. To divide a mixt Number by a Decimal ; as 1.25999 by .002 : and to have 4 Decimal Places in the Quotient.

$$.002) 1.2599900 (629.9950$$

Half the Dividend gives the Figures of the Quote.

Example 8. To divide a whole Number by a Decimal, as 999 by .00013 ; and to have only 3 Decimal places in the Quote.

Example 9. To divide a Decimal by a mixt Number, as .5 by 7.5 ; and to have 2 places Decimal in the Quotient : which are sufficient in case of Decimals of a Gallon, and the Quotient not required to be multiplied by any thing ; as follows.

$$7.5) .500 (.06 \text{ r } 50$$

$$365) 5.0000000000 (.0136986301$$

$$\begin{array}{r} 1350 \\ 2550 \\ 3600 \\ 3150 \\ 2300 \\ 1100 \\ 0500 \\ 135 \end{array}$$

$$.00013) 999.00000000 (7684615.384$$

$$\begin{array}{r} 89 \\ 110 \\ 60 \\ 80 \\ 20 \\ 70 \\ 50 \\ 110 \\ 60 \\ 8 \text{ refts.} \end{array}$$

These are all the Varieties that can happen in Division of Decimals : And the Exemplification of the two Rules first above, appear at one View thus.

The 9 Cases.	Divisors.	Dividends given.	Cyphers added as per Rule 1. above.	Quotients ; having Decimals, as per Rule 2.
1	25.324	237.34691084		9.37241.
2	932.	11.50554	0	.012345.
3	.321	.1234567	000	.3846003
4	3214	.463	00000	.00014405
5	3.214	9.	000000000000	2.800248911
6	365.	5.	0000000000	.0136986301
7	.002	1.25999	00	629.9950
8	.00013	999.	00000000	7684615.384
9	7.5	.5	00	.0671

Of Decimal by way of Vulgar Fractions.

To work any Question so as to give the Answer exquisitely (without omitting any thing) by Decimals as well as by Vulgar Fractions. [Note, This is my own Thought, as the rest of what is new in Decimals is.]

It has been one great Objection against Decimals, that where the Decimals in Quotients happen not to be compleat, but infinite, the Answer cannot be exhibited so accurately, as to be truly said to be the whole Truth : But this is easily solved, by considering the Nature of the Remainders in the dividing and making a Fraction of that and the Divisor.

So that the Proof of this depends both upon Vulgar and Decimal Fractions worked promiscuously, or of Decimal worked by way of Vulgar Fractions.

To instance in Example 3. foregoing, the true Quote (as in the Margin below is proved) is $= .3846003 \dots \frac{37}{321}$: For the 37 is what remained in dividing the last part of the Dividend ; and besides the 2 places next the right hand thereof, there being 8 more Decimal places towards the left hand, therefore so many Cyphers are in the Numerator of that part expressed by way of Vulgar Fractions, which must always be observed.

The Truth of this appears by reducing this mixt Number to one Fraction : for the Product of .3846003 multiplied by the Denominator .321, produceth .1234566963 ; to which adding the Numerator, the Sum is .1234567 : which placed over the Denominator

tor

tor .321, gives the Fraction answer-
able to the first proposed Question in
Example 3.

Example 3.
And by the same Rules the Quote or Answer in the 4th Example is to be expressed thus $.00014405 \frac{000}{3} \frac{0233}{214}$. Which if reduced into a single Fraction, as before, is $\frac{1}{3} \frac{4}{2} \frac{6}{1} \frac{3}{4}$.

So likewise the accurate Answer
or Quotient in *Example 5.* is $.2800248911 \frac{\circ \circ \circ \circ \circ \circ \circ \circ}{3 \cdot 2 \frac{4}{4}}$, reducible to $\frac{2}{3} \cdot 2 \frac{2}{4}$.

In Example 6. the exact Quote is consequently = .0136986301
 $\frac{1}{3} \frac{3}{8} \frac{5}{5}$: or by the Rules above $\frac{1}{3} \frac{3}{8} \frac{5}{5}$ in a simple Fraction for
 Proof.

In Example 8. The precise Quotient is $7684615.384^{\circ\circ\circ\frac{\circ\circ\circ\circ}{13}}$.
Or by reducing the 2 sorts of Fractions to one Fraction, the whole
will stand thus; $7684615:\frac{\circ\circ\circ\circ}{13}$ without any loss: which (for
Proof) is reducible to $\frac{\circ\circ\circ\circ}{13}$.

Lastly, In *Example 9*. The true Quote is $.0666 \text{ r } 1$, or rather $.06\frac{2}{3}$; whose Value (if the Fraction of a Pound) is known to be $16d$. We will try if it will prove so by the Method shew'd above.

The 50 remaining (by the Rule relating to the third Example) is .050, there being 1 more place Decimal towards the left hand besides the 2 places in the Remainder : so that the .06 $\frac{0}{7} \cdot \frac{5}{5}$ includes the whole Answer without any Loss, as *per* the Work in the Margin; and is reduced to $\frac{5}{7} \cdot \frac{5}{5}$, whose Value, as *per* Vulgar Fractions, having respect to the Points, as in Multiplication and Division of Decimals, is 1 s. 4 d.

The new Fract. = $\frac{5}{7.5}$ l.

7.5 } mult.
 $\frac{.06}{.450}$
 $\frac{.05}{.500}$ Sum.

The Value is thus found, as of Vulgar;

.5
 . 20

 7.5) 10.0 (1 s.

3. *Note*, That to divide any Decimal, Whole, or Mixt Number by a Unit with Cyphers, is only to remove the Point so many places towards the left hand, as there are Cyphers. Thus,

.321

add $\left\{ \begin{array}{l} .1234566963 \\ .00000000037 \end{array} \right.$

or $\frac{.1234567}{.321}$ for Proof.

7.5 } mult.
.06 }

$\left. \begin{array}{l} .45^{\circ} \\ .05 \end{array} \right\} \text{add.}$

.500 Sum.

2.5

12

7.5) 30.0 (4 Pence.

○

If 10 divide 98765.4 the Quote is 9876.54
 100 divide it, 987.654
 1000 98.7654
 10000 9.87654
 100000 .987654
 1000000 .0987654

4. Or if 60 divide 98765.4 the Quote is 1646.09
 600 164.609
 6000 16.4609
 60000 1.64609
 600000 .164609

Dividing only by the 6, and cutting off so many from the Quote (besides the Decimal Places in the Dividend) as there are Cyphers in the Divisor.

5. That Division of Decimals is performed as that of Vulgar Fractions.

As if $\frac{1234567}{321}$ be divided by $\frac{321}{1000}$, the Quote will be $\frac{1234567000}{321000}$ equal to the Decimal Quote .3846003, by dividing the Numerator by 321, and cutting as many from the Quotient as there are Cyphers to the right of 321, as *per* Margin.

$$\begin{array}{r} 321 \overline{) 1234567000} \\ 1000 \overline{) 1234567000} \end{array} \left(\frac{1234567000}{321000} \right)$$

$$321 \overline{) 1234567000} \quad (.3846003)$$

SECT. VII. The Rule of Proportion by Decimals.

THIS being the same as in whole Numbers, observing Multiplication and Division of Decimals for the proper Rules of pointing out the Products and Quotients; I need only give one Example.

What is the Interest of £. 325 : 15 : — for a Year, at 4 l. 10 s. *per Cent. per Annum*?

The Answer is £. 14.65775, as *per* Compend. 6, &c. or £. 14 : 13 : 1 $\frac{3}{4}$, by the 6th Rule of the Valuation of Decimals.

$$\begin{array}{r} 100. \quad 4.5 :: 325.75 \\ \quad \quad 4.5 \\ \hline \end{array}$$

£. 14.65775 Answer.

And this puts me in mind of

SECT. VIII. The Use of Decimals in the calculating Interest Simple and Compound.

I. **SIMPLE** Interest is the Interest of the Principal only, for the time proposed.

II. The true Discount of Money is in proportion to its Principal: As 5 is to 105 (at 5 per Cent.) or as 6 to 106 at 6 per Cent. &c. So that the Discount of any Sum for any time is less than the Interest for that time, and consequently the Discount of any Sum at any rate is found for a Year by this Proportion:

As 100 and the Rate: is to the Rate: to any Sum to the Discount for the same time.)

III. Compound Interest is the Interest of the Principal and of the Interest put together, (the latter not being paid when due, but becomes Principal.)

I. As to Simple Interest, there are Laws in most Countries to ascertain it, that no one shall take more, under the penalty of forfeiting the Principal, &c. as now ours is 5 per Cent. for what is lent for the future.

To find the Simple Interest of any Sum for a Year.

(1.) What is the Interest of £364 : 17 : 5 $\frac{1}{4}$ at 5 per Cent?

As 100. 5 :: 364 : 17 : 5 $\frac{1}{4}$

Ans. £18 : 4 : 10 $\frac{1}{2}$

Multiply the whole by 5,
and divide by 100 continually,
as you see here,

$$\begin{array}{r}
 \text{£} 364 : 17 : 5\frac{1}{4} \\
 \times 5 \\
 \hline
 \text{£} 1824 : 7 : 2\frac{1}{4} \\
 \times 100 \\
 \hline
 \text{s. } 487 \\
 \times 12 \\
 \hline
 \text{d. } 1046 \\
 \times 4 \\
 \hline
 \text{qr. } 185
 \end{array}$$

(2.) But if the Shillings, &c. are easily by Inspection reducible to a compleat Decimal, the best way is to do such Questions decimally.

Example.

Example. What is the Interest of $l. 364 : 18 : —$ for a Year, at 5 per Cent?

See the Operation in the Margin,
the Answer being $l. 18 : 4 : 10 \frac{1}{4}$.

$$\begin{array}{r} 100. \ 5 :: 364.9 \\ \hline 5 \end{array}$$

18.245 Answer.

(3.) If the Interest of any Sum be required for any Number of Days (or Part of a Year) 'tis best done by Decimals.

Example. Suppose the Interest of the Principal in the last Case is required only for 145 Days :

$$\begin{array}{r} \text{1st say, } 100. \ 5 :: 364.9 \\ \hline 5 \end{array}$$

the Interest = 18.245 for 1 Year.

$$\begin{array}{r} \text{Days.} \quad l. \quad \text{Days.} \\ \text{2dly, } 365. \ 18.245 :: 145 \\ \hline 145 \end{array}$$

$$\begin{array}{r} \hline l. \\ 365) 2645.525 (7.248\frac{2}{3}\frac{2}{3} = \text{Answer.} \end{array}$$

$$\begin{array}{r} \hline 905 \\ \hline 1752 \\ \hline 2925 \\ \hline 5 \end{array}$$

2. And consequently the Interest of the said $l. 364 : 17 : 11 \frac{1}{4}$ for 314 Days is found, reducing the odd Money to Decimals, as per the second Rule in Reduction, which is $l. 871875$: Therefore

$$100. \ 5 :: 364.871875. \ 18.2435937 = \text{Int. for a Year.}$$

$$\begin{array}{r} \text{Days.} \quad l. \quad \text{Days.} \quad l. \\ 365. \ 18.2435937 :: 314. \ 15.694 = \text{the Answer.} \end{array}$$

3. By the same Rule with the two last, the Interest of $l. 1$ for one Day at any rate is found, and they are Multipliers for finding the Simple Interest of any Number of Pounds for any Days :

$$\left\{ \begin{array}{l} \text{For } 100. \ 5 :: 1. \ .05 \\ \text{And as } 365. \ .05 :: 1. \ .000136, \text{ \&c.} \end{array} \right.$$

Thus

Thus 1 l. for 1 Day at 4 per Cent. = .00010958904
 5 per Cent. is .0001369863
 at 6 per Cent. = .00016438356
 at 7 per Cent. = .00019178082
 8 per Cent. = .00021917808

} Factors for finding the Interest for Days.

These Numbers may be thus used : Suppose I would know the Interest of $l.400$ for 297 Days at 5 per Cent. I multiply $.0001369863$ by 297, and the Product is the Interest of $l.1$ for 297 Days ; which Product multiplied by $l.400$, gives the Interest of $l.400$ for 297 Days = the Answer, $l.16 : 5 : 5\frac{3}{4}$.

4. If you divide 100 by the Rate of Interest, it gives the Years Purchase in Fee of Lands Value in many places. And consequently if 100 be divided by the Years Purchase that the generality of Lands are valued at, the Quote gives the proportionable Rate of Interest. Which is a Rule that many go by, to know whether Interest is too high or low, by observing how Lands sell: It happens right with us at present, for 5 *per Cent.* agrees with 20 Years Purchase of Land.

5. It is easy to find the Simple Interest of any Sum for any Number of Years, as suppose $l. 100 : 15$, for 7 Years at 5 *per Cent.* say

$$100.5 :: 100.75. \quad 5.0375 = \text{Int. for 1 Year.}$$

$$7 \text{ mult.}$$

$$35.2625 = \text{Answer, or } l. 35 : 5 : 3$$

6. And consequently for the Interest of a Sum under $\text{£}1$, as 1 s.

100. 5 : : .75. .0375 for 1 Year; or .2625 l. for 7 Years.

7. Finding the Interest of £. 732 for 5 Years to be £. 183, what is that *per Cent. per Ann.*? I first divide £. 183 by 5 Years, and the Quote is £. 36.6. Then say, As 732. 36.6. :: 100. 5 *per Cent.*
Answer.

Here followeth Tables of Interest, Simple, Compound, and Discount,
with their Calculation and Use.

A TABLE of SIMPLE INTEREST at 4 per Cent.

Principal.	1 Day.			2 Days.			3 Days.			4 Days.			5 Days.			6 Days.			7 Days.			8 Days.		
	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.
1	1000	109	589																					
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
20																								
30																								
40																								
50																								
60																								
70																								
80																								
90																								
100																								
200																								
300																								
400																								
500																								
600																								
700																								
800																								
900																								
1000																								
ditto	109589			219178			328767			438356			547945			657534			767123			876712		

SIMPLE INTEREST at 4 per Cent.

	9 Days.			10 Days.			20 Days.			30 Days.			40 Days.			50 Days.			60 Days.													
Prin- cipal	s.	d.	q.	h.	s.	d.	q.	V.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.					
1			1				1					2				3				1	0			1	1			1	2			
2			2				2					1	0			1	2			2	0			2	2			3	1			
3			3				3					1	2			2	1			3	1			4	0			4	3			
4		1	0				1	0				2	1			3	1			4	1			5	1			6	1			
5		1	1				1	1				2	3			4	0			5	1			6	2			7	3			
6		1	2				1	2				3	1			4	3			6	1			7	3			9	2			
7		1	3				1	3				3	3			5	2			7	1			9	1			11	1			
8		2	0				2	1				4	1			6	1			8	2			10	2		1	—	2			
9		2	1				2	2				4	3			7	0			9	2			1	—	0		1	2	1		
10		2	2				2	3				5	1			7	3			10	2			1	1	0		1	3	3		
20		4	3				5	1			10	2			1	3	3			1	9	0		2	2	1		2	7	2		
30		7	0				7	3			1	3	3			1	11	3		2	7	2		3	3	1		3	11	2		
40		9	2				10	2			1	9	0			2	7	2		3	6	0		4	4	3		5	3	1		
50		—	0				1	0			2	2	1			3	3	2		4	4	3		5	5	3		6	7	0		
60		2	1				1	3	3		2	7	2			3	11	2		5	3	1		6	7	0		7	10	3		
70		4	2				1	6	2		3	—	3			4	7	1		6	1	2		7	8	0		9	2	2		
80		7	0				1	9	0		3	6	0			5	3	1		7	—	0		8	9	1		10	6	1		
90		9	1				1	11	3		3	11	2			5	11	0		7	10	3		9	10	2		11	10	0		
100		11	3				2	2	1		4	4	3			6	7	0		8	9	1		10	11	2		13	1	3		
200		11	2				4	4	3		8	9	1			13	1	3		17	6	2		1	11	0		1	6	3	3	
300		11	0				6	7	0		13	1	3			19	8	3		1	6	3	3	1	12	10	2		1	19	5	2
400		10	3				8	9	1		17	6	2			1	6	3	3	1	15	—	3	2	3	10	0		2	12	7	1
500		10	2				10	11	2		1	11	0			1	12	10	2	2	3	10	0	2	14	9	2		3	5	9	0
600		10	0				13	1	3		1	6	3	3		1	19	5	2	2	12	7	1	3	5	9	0		3	18	11	0
700		9	3				15	4	0		1	10	8	1		2	6	—	1	3	1	4	2	3	16	8	2		4	12	—	2
800		9	2				17	6	2		1	15	—	3		2	12	7	1	3	10	1	2	4	7	8	0		5	5	2	2
900		9	0				19	8	3		1	19	5	2		2	19	2	0	3	18	11	0	4	18	7	2		5	18	4	1
1000		8	3				1	11	0		2	3	10	0		3	5	9	0	4	7	8	0	5	9	7	0		6	11	6	0
ditto	1.986301			1.09589			2.191781					3.287671				4.383562				5.479452				6.575342								

SIMPLE INTEREST at 4 per Cent.

Principal.	70 Days.				80 Days.				90 Days.				100 Days.				110 Days.				120 Days.				
	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	
1			1	3			2	0			2	1			2	2			3	0			3	1	
2			3	3			4	1			4	3			5	1			5	3			6	1	
3			5	2			6	1			7	0			7	3			8	3			9	3	
4			7	1			8	2			9	2			10	2			11	3			1	2	
5			9	1			10	2			1	0			1	1	1		1	2	2		1	3	
6			11	0			1	2			1	2	1		1	3	3		1	5	2		1	7	
7			1	3			1	2	3			1	4	3		1	6	2		1	8	1		1	10
8			1	2	3			1	5	0		1	7	0		1	9	0		1	11	1		2	1
9			1	4	3			1	7	0		1	9	1		1	11	3		2	2	0		2	4
10			1	6	2			1	9	0		1	11	3		2	—	0		2	5	0		2	7
20			3	—	3			3	6	0		3	11	2		4	4	3		4	10	0		5	3
30			4	7	1			5	3	1		5	11	0		6	17	0		7	2	3		7	10
40			6	1	2			7	—	0		7	11	0		8	19	1		9	7	3		10	6
50			7	8	0			8	9	1		9	10	2		10	11	2		12	—	2		13	1
60			9	2	2			10	6	1		11	10	0		13	1	3		14	5	2		15	9
70			10	8	3			12	1	3	1	13	9	3		15	4	1		16	10	2		18	4
80			12	3	1			14	—	1		15	9	1		17	6	1		19	3	2		1	1
90			13	9	3			15	9	2		17	9	0		19	8	3		1	1	8	1	1	3
100			15	4	1			17	6	2		19	8	3		1	1	11	0	1	4	1	1	1	6
200	1	10	8	1	1	15	—	3	1	19	5	1	2	3	10	0	2	8	2	2	2	12	7	3	2
300	2	6	—	1	2	12	7	1	2	19	2	1	3	5	9	0	3	12	4	0	3	18	11	0	3
400	3	1	4	2	3	10	1	2	3	18	11	0	4	7	8	0	4	16	5	1	5	5	2	4	5
500	3	16	8	2	4	7	8	0	4	18	7	2	5	9	7	0	6	—	6	2	6	11	6	4	6
600	4	12	—	3	5	5	2	2	5	18	4	1	6	11	6	0	7	4	7	3	7	17	9	1	7
700	5	7	4	3	6	2	8	3	6	18	—	0	7	13	5	0	8	8	9	1	9	4	1	8	8
800	6	2	8	3	7	—	3	1	7	17	9	3	8	15	4	0	9	12	10	2	10	10	5	9	9
900	6	18	1	0	7	17	9	3	8	17	6	2	9	17	3	0	10	16	11	3	11	16	8	0	10
1000	7	13	5	0	8	15	4	1	9	17	3	1	10	19	2	1	12	1	1	0	13	3	—	1	11
ditto	47.67	12	33		8.76	7	12	3	9.86	3	0	14	10.95	8	9		12.05	4	7	9	4	13.15	0	68	

SIMPLE INTEREST at 4 per Cent.

	130 Days.				140 Days.				150 Days.				160 Days.				170 Days.				180 Days.									
Prin- cipal.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.						
1			3	2			3	3			4	0			4	1			4	2			4	3						
2			6	3			7	1			7	3			8	2			9	0			9	2						
3			10	1			11	0			1	0	0		1	0	2		1	1	2		1	2	1					
4			1	1	3		1	2	3			1	4	0		1	5	0		1	5	3		1	7	0				
5			1	5	1		1	6	2			1	7	3		1	9	0		1	10	1		1	11	3				
6			1	8	2		1	10	1			1	11	3		2	1	1		2	2	3		2	4	2				
7			2	0	0		2	1	3			2	3	3		2	5	2		2	7	1		2	9	1				
8			2	3	1		2	5	2			2	7	2		2	9	3		2	11	3		3	1	3				
9			2	6	3		2	9	1			2	11	2		3	1	3		3	4	1		3	6	2				
10			2	10	1		3	0	3			3	13	2		3	6	0		3	8	3		3	11	2				
20			5	8	1		6	1	2			6	17	0		7	10	0		7	5	2		7	10	3				
30			8	6	2		9	2	2			9	10	2		10	16	1		11	2	0		11	10	0				
40			11	4	3		12	3	1			13	1	3		14	0	1		14	11	0		15	9	2				
50			14	3	0		15	4	1			16	5	1		17	6	2		18	7	2		19	8	3				
60			17	1	0		18	5	0			19	8	3		1	1	0	2	1	2	4	1	1	3	8	0			
70			19	11	2		1	1	5	3		1	13	0	0		1	4	6	1	1	6	1	0	1	7	7	1		
80			1	2	9	2		1	4	6	2		1	16	0	3		1	8	0	3	1	9	9	3	1	11	6	3	
90			1	5	7	3		1	7	7	1		1	19	7	0		1	11	6	3	1	13	6	2	1	15	6	0	
100			1	8	6	0		1	10	8	1		1	12	10	2		1	15	0	3	1	17	3	1	1	19	5	2	
200			2	17	0	0		3	1	4	2		3	5	9	0		3	10	1	2	3	14	6	1	3	18	11	0	
300			4	5	5	3		4	12	0	2		4	18	7	2		5	5	2	2	5	11	9	2	5	18	4	1	
400			5	13	11	3		6	2	8	3		6	11	6	0		7	0	3	1	7	9	0	2	7	17	9	3	
500			7	2	5	2		7	13	5	0		8	4	4	3		8	15	4	1	9	6	3	3	9	17	3	1	
600			8	10	11	2		9	4	1	1		9	17	3	1		10	10	5	0	11	3	6	3	11	16	8	2	
700			9	19	5	2		10	14	9	2		11	10	11	2		12	5	5	3	13	0	10	0	13	16	2	0	
800			11	7	11	2		12	5	5	3		13	3	0	0		14	0	6	2	14	18	1	0	15	15	6	3	
900			12	16	5	1		13	16	2	0		14	15	10	3		15	15	7	1	16	15	4	1	17	15	0	3	
1000			14	4	11	1		15	6	10	1		16	8	9	1		17	10	8	1	18	12	7	1	19	14	6	1	
ditto	l.	14	24	65	74		15	34	24	64		16	43	83	54		17	53	42	44		18	63	01	34		19	72	60	24

SIMPLE INTEREST at 4 per Cent.

	190 Days.				200 Days.				210 Days.				220 Days.				230 Days.				240 Days.					
Principal.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.		
1			5	0			5	1			5	2			5	3			6	0			6	1		
2			10	0			10	2			11	0			11	3			1	0	0		1	0	2	
3		1	3	0		1	3	3		1	4	3			1	5	2		1	6	0		1	7	0	
4		1	8	0		1	9	0		1	10	0			1	11	1		2	0	0		2	1	1	
5		2	1	0		2	2	1		2	3	3			2	5	0		2	6	1		2	7	2	
6		2	6	0		2	7	2		2	9	1			2	10	3		3	0	1		3	1	3	
7		2	11	0		3	0	3		3	2	3			3	4	2		3	6	1		3	8	1	
8		3	4	0		3	6	0		3	8	1			3	10	1		4	0	1		4	2	2	
9		3	9	0		3	11	2		4	1	3			4	4	0		4	6	2		4	8	3	
10		4	2	0		4	4	3		4	7	1			4	10	0		5	0	2		5	3	1	
20		8	4	0		8	9	1		9	2	2			9	7	3		10	1	0		10	6	1	
30		12	6	0		13	1	3		13	9	2			14	5	3		15	1	2		15	9	1	
40		16	7	3		17	6	2		18	5	0			19	3	2		1	0	2	0	1	1	0	2
50	1	0	10	0	1	1	11	0	1	3	0	0	1	4	1	1	1	5	2	2	1	6	3	3		
60	1	5	0	0	1	6	3	3	1	7	7	1	1	8	11	1	1	10	3	0	1	11	6	3		
70	1	9	1	3	1	10	8	1	1	12	2	2	1	13	9	0	1	15	3	2	1	16	10	0		
80	1	13	4	3	1	15	0	3	1	16	10	0	1	18	7	0	2	0	4	0	2	2	1	0		
90	1	17	5	3	1	19	5	2	2	1	5	0	2	3	4	3	2	5	4	2	2	7	4	1		
100	2	1	7	3	2	3	10	0	2	6	0	1	2	8	2	2	2	10	5	0	2	12	7	1		
200	4	3	3	2	4	7	8	0	4	12	0	2	4	16	5	1	5	0	10	0	5	5	2	2		
300	6	4	11	1	6	11	6	0	6	18	1	0	7	4	7	3	7	11	2	3	7	17	9	3		
400	8	6	6	3	8	15	4	0	9	4	1	1	9	12	10	2	10	1	7	3	10	10	5	0		
500	10	8	2	2	10	19	2	0	11	10	1	2	12	1	1	0	12	12	0	3	13	3	0	0		
600	12	9	10	2	13	3	0	0	13	16	2	0	14	9	3	3	15	2	5	2	15	15	7	1		
700	14	11	6	0	15	6	10	1	16	2	2	1	16	17	6	2	17	12	10	2	18	8	2	2		
800	16	13	1	3	17	10	8	1	18	8	2	2	19	5	9	0	20	3	3	2	21	0	10	0		
900	18	14	9	2	19	14	6	1	20	14	3	0	21	13	11	3	22	13	8	1	23	13	5	0		
1000	20	16	5	1	21	18	4	1	23	0	3	1	24	2	2	1	25	4	1	1	26	6	0	1		
ditto	20.82	19	14		21.91	7	8	05	23.01	3	6	95	24.10	9	5	85	25.20	5	4	76	26.30	1	3	66		

SIMPLE INTEREST at 4 per Cent.

	250 Days.	260 Days.	270 Days.	280 Days.	290 Days.	300 Days.
Principal.	l. s. d. q.	l. s. d. q.	l. s. d. q.	l. s. d. q.	l. s. d. q.	l. s. d. q.
1	6 2	6 3	7 0	7 1	7 2	7 3
2	1 1 0	1 1 2	1 2 1	1 2 3	1 3 1	1 3 3
3	1 7 3	1 8 2	1 9 1	1 10 0	1 11 0	1 11 3
4	2 2 1	2 3 1	2 4 2	2 5 2	2 6 2	2 7 2
5	2 8 3	2 10 1	2 11 2	3 0 3	3 2 0	3 3 2
6	3 3 2	3 5 0	3 6 2	3 8 1	3 9 3	3 11 2
7	3 10 0	4 0 0	4 1 3	4 3 2	4 5 1	4 7 1
8	4 4 2	4 6 3	4 8 3	4 11 0	5 1 0	5 3 1
9	4 11 1	5 1 2	5 4 0	5 6 1	5 8 3	5 11 0
10	5 3 1	5 8 1	5 11 0	6 1 2	6 4 1	6 7 0
20	10 11 2	11 4 3	11 10 0	12 3 1	12 8 2	13 1 3
30	16 5 1	17 1 0	17 9 0	18 5 0	19 0 3	19 8 3
40	1 1 11 0	1 2 9 2	1 3 8 0	1 4 6 2	1 5 5 0	1 6 3 3
50	1 7 4 3	1 8 6 0	1 9 7 0	1 10 8 1	1 11 9 2	1 12 10 2
60	1 12 10 3	1 14 2 1	1 15 6 0	1 16 10 0	1 18 1 2	1 19 5 2
70	1 18 4 1	1 19 10 3	2 1 5 0	2 2 11 2	2 4 6 0	2 6 0 1
80	2 3 10 0	2 5 7 0	2 7 4 0	2 9 1 1	2 10 10 1	2 12 7 1
90	2 9 3 3	2 11 3 2	2 13 3 1	2 15 2 3	2 17 2 2	2 19 2 0
100	2 14 9 2	2 17 0 0	2 19 2 1	3 1 4 2	3 3 6 3	3 5 9 0
200	5 9 7 0	5 13 11 3	5 18 4 1	6 2 8 3	6 7 1 2	6 11 6 0
300	8 4 4 2	8 10 11 2	8 17 6 2	9 4 1 1	9 10 8 1	9 17 3 1
400	10 19 2 0	11 7 11 2	11 16 8 2	12 5 5 3	12 14 3 0	13 3 0 0
500	13 13 11 3	14 4 11 1	14 15 10 3	15 6 10 1	15 17 9 3	16 8 9 1
600	16 8 9 1	17 1 11 0	17 15 0 3	18 8 2 2	19 1 4 2	19 14 6 1
700	19 3 6 3	19 18 11 0	20 14 3 0	21 9 7 0	22 4 11 1	23 0 3 1
800	21 18 4 1	22 15 10 3	23 13 5 0	24 10 11 2	25 8 6 0	26 6 0 1
900	24 13 1 3	25 12 10 2	26 12 7 1	27 12 4 0	28 12 0 3	29 11 9 2
1000	27 7 11 2	28 9 10 1	29 11 9 2	30 13 8 1	31 15 7 1	32 17 6 2
ditto	27.397256	28.49315	29.58904	30.68493	31.78082	32.87671

SIMPLE INTEREST *at 4 per Cent.*

	310 Days.	320 Days.	330 Days.	340 Days.	350 Days.	360 Days.	365 Days or 1 Year
Principal.	l. s. d. q.	l. s. d. q.	l. s. d. q.	l. s. d. q.	l. s. d. q.	l. s. d. q.	l. s. d. q.
1	8 1	8 2	8 3	9 0	9 1	9 2	9 3
2	1 4 1	1 5 0	1 5 2	1 6 0	1 6 2	1 7 0	1 7 1
3	2 0 2	2 1 1	2 2 0	2 2 3	2 3 3	2 4 2	2 5 0
4	2 8 2	2 9 3	2 10 3	2 11 3	3 0 3	3 1 3	3 2 1
5	3 4 3	3 6 0	3 7 1	3 8 3	3 10 0	3 11 2	4 0 0
6	4 0 3	4 2 2	4 4 0	4 5 3	4 7 1	4 8 3	4 9 1
7	4 9 0	4 11 0	5 0 3	5 2 2	5 4 2	5 6 1	5 7 0
8	5 5 1	5 7 1	5 9 2	5 11 2	6 1 2	6 3 3	6 5 0
9	6 1 1	6 3 3	6 6 0	6 8 2	6 11 0	7 1 1	7 2 0
10	6 9 2	7 0 0	7 2 3	7 5 2	7 8 0	7 10 3	8 0 0
20	13 7 0	14 0 1	14 5 2	14 11 0	15 4 0	15 9 2	16 0 0
30	1 0 4 3	1 1 0 2	1 1 8 1	1 2 4 1	1 3 0 0	1 3 8 0	1 4 0 0
40	1 7 2 0	1 8 0 3	1 8 11 1	1 5 9 3	1 10 8 1	1 11 6 3	1 12 0 0
50	1 13 11 3	1 15 0 3	1 16 2 0	1 17 3 1	1 18 4 1	1 19 5 2	2 0 0 0
60	2 0 9 1	2 2 1 0	2 3 4 3	2 4 8 2	2 6 0 1	2 7 4 1	2 8 0 0
70	2 7 6 3	2 9 1 1	2 10 7 2	2 12 2 0	2 13 8 1	2 15 2 3	2 16 0 0
80	2 14 4 1	2 16 1 1	2 17 10 2	2 19 7 1	3 1 4 2	3 3 1 2	3 4 0 0
90	3 1 1 3	3 3 1 2	3 5 1 1	3 7 0 3	3 9 0 2	3 11 0 0	3 12 0 0
100	3 7 11 2	3 10 1 3	3 12 4 0	3 14 6 1	3 16 8 2	3 18 11 0	4 0 0 0
200	6 15 10 3	7 0 3 1	7 4 7 3	7 9 0 2	7 13 5 0	7 17 9 3	8 0 0 0
300	10 3 10 0	10 10 5 0	10 16 11 3	11 3 6 3	11 10 1 2	11 16 8 2	12 0 0 0
400	13 11 9 2	14 0 6 2	14 9 4 3	14 18 1 0	15 6 10 1	15 15 7 1	16 0 0 0
500	16 19 8 3	17 10 8 1	18 1 7 3	18 12 7 1	19 3 6 3	19 14 6 1	20 0 0 0
600	20 7 8 0	21 0 10 0	21 13 11 3	22 7 1 2	23 0 3 1	23 13 5 0	24 0 0 0
700	23 15 7 1	24 10 11 2	25 6 3 3	26 1 7 3	26 17 0 0	27 12 4 0	28 0 0 0
800	27 3 6 3	28 1 1 1	28 18 7 2	29 16 2 0	30 13 8 1	31 11 2 3	32 0 0 0
900	30 11 6 0	31 11 2 3	32 10 11 2	33 10 8 1	34 10 5 0	35 10 1 3	36 0 0 0
1000	33 19 5 2	35 1 4 2	36 3 3 2	37 5 2 2	38 7 1 2	39 9 0 2	40 0 0 0
ditto	l. 33.97.26	35.06.49	36.16.43.8	37.26.02.7	38.35.6.16	39.45.20.6	40.0

A TABLE of SIMPLE INTEREST
at 5 per Cent.

	1 Day.			2 Days.			3 Days.			4 Days.			5 Days.			6 Days.			7 Days.			8 Days.				
Principal.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	l.	s.	d.	q.	
1	1.000	13	699																							
2																										
3																										
4																										
5																										
6																										
7																										
8																										
9																										
10																										
20																										
30																										
40																										
50																										
60																										
70																										
80																										
90																										
100																										
200																										
300																										
400																										
500																										
600																										
700																										
800																										
900																										
1000																										
ditto	l. .1369			l. .2739			l. .4109			l. .5479			l. .6849			l. .8219			l. .9589			l. 1.0956				

SIMPLE INTEREST at 5 per Cent.

Principal £.	9 Days.				10 Days.				20 Days.				30 Days.				40 Days.				50 Days.				60 Days.							
	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.				
1				1				1				2				10				1	1			1	2			20				
2				2				2				1	1			20				2	2			3	1			40				
3				3				1	0			2	0			30				4	0			5	0			53				
4				1	1			1	1			2	2			40				5	1			6	2			73				
5				1	2			1	2			3	1			50				6	2			8	1			93				
6				1	3			2	0			4	0			53				7	3			10	0			113				
7				2	0			2	1			4	3			63				9	1			11	2		1	13				
8				2	1			2	2			5	1			73				10	2			1	10		1	33				
9				2	3			3	0			5	3			83				11	3			1	23		1	53				
10				3	0			3	1			6	2			100				1	10			1	42		1	73				
20				5	3			6	2		1	10			1	73				2	2	1		2	83		3	32				
30				8	3			10	0		1	73			2	52				3	32			4	11		4	11				
40				11	3			1	10		2	2	1		3	32				4	43			5	52		6	63				
50				1	2	3		1	42		2	83			4	11				5	53			6	100		8	22				
60				1	5	2		1	73		3	32			4	11	1			6	63			8	22		9	101				
70				1	8	3		1	110		3	100			5	90				7	80			9	70		11	60				
80				1	11	2		2	2	1		4	43			6	63			8	9	1		10	112		13	13				
90				2	2	2		2	5	2		4	11	1		7	43			9	102			12	40		14	92				
100				2	5	2		2	8	3		5	53			8	22			10	112			13	80		16	51				
200				4	11	0		5	5	2		10	112			16	5	1		1	1110			1	7	43	1	12	102			
300				7	4	2		8	2	2		16	5	1		1	4	73		1	12	102			2	1	10	2	9	33		
400				9	10	1		10	112		1	1	1110			1	12	102		2	3	100			2	14	92	3	5	90		
500				12	4	0		13	8	1		7	43			2	1	10		2	14	92			3	8	53	4	2	21		
600				14	9	2		16	5	0		1	12	102			2	9	33		3	5	90			4	2	2	1	4	18	72
700				17	3	0		19	2	0		1	18	4	1		2	17	6	1	3	16	82			4	15	103	5	15	03	
800				19	8	3		1	1	110		2	3	100			3	5	90		4	7	80			5	9	70	6	11	60	
900				1	2	2	1		4	73		2	9	33			3	13	113		4	18	72			5	3	33	7	7	11	1
1000				1	4	73			7	43		2	14	92			4	2	2	1	5	9	70			6	16	113	8	4	42	
ditto	£ 1.2328				£ 1.3698				£ 2.7396				£ 4.1094				£ 5.4792				£ 6.8490				£ 8.2188							

SIMPLE INTEREST at 5 per Cent.

	70 Days.				80 Days.				90 Days.				100 Days.				110 Days.				120 Days.				
Principal.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	
1			2	1			2	3				3	0			3	1			3	2			4	0
2			4	2			5	1				5	3			6	2			7	1			7	3
3			6	3			7	3				8	3			9	3			10	3			11	3
4			9	1			10	2				11	3		1	1	0		1	2	2		1	3	3
5			11	2		1	1	0		1	2	3		1	4	2		1	6	0		1	7	3	
6		1	1	3		1	3	3		1	5	3		1	7	3		1	9	2		1	11	2	
7		1	4	0		1	6	1		1	8	3		1	11	0		2	1	1		2	3	2	
8		1	6	1		1	9	0		1	11	2		2	2	1		2	5	0		2	7	2	
9		1	8	3		1	11	2		2	2	2		2	5	2		2	8	2		2	11	2	
10		1	11	0		2	2	1		2	5	2		2	8	3		3	0	0		3	3	2	
20		3	10	0		4	4	2		4	11	0		5	5	3		6	0	1		6	6	3	
30		5	9	0		6	6	3		7	4	3		8	2	2		9	0	2		9	10	1	
40		7	8	0		8	9	1		9	10	1		10	11	2		12	0	2		13	1	3	
50		9	7	0		10	11	2		12	4	0		13	8	1		15	0	3		16	5	1	
60		11	6	0		13	1	3		14	9	2		16	5	1		18	1	0		19	8	2	
70		13	5	0		15	4	0		17	3	1		19	2	0		1	1	1	0	1	3	0	0
80		15	4	0		17	6	1		19	8	2		1	1	11	0	1	4	1	1	1	6	3	2
90		17	3	0		19	8	3		1	2	2	1	1	4	7	3	1	7	1	2	1	9	7	0
100		19	2	0		1	1	11	0	1	4	7	3	1	7	4	3	1	10	1	2	1	12	10	2
200	1	18	4	1		2	3	10	0	2	9	3	3	2	14	9	2	3	0	3	1	3	5	9	0
300	2	17	6	1		3	5	9	0	3	13	11	2	4	2	2	1	4	10	5	0	4	18	7	2
400	3	16	8	2		4	7	8	0	4	18	7	2	5	9	7	0	6	0	6	2	6	11	6	0
500	4	15	10	3		5	9	7	0	6	3	3	2	6	16	11	3	7	10	8	1	8	4	4	2
600	5	15	0	3		6	11	6	0	7	7	11	1	8	4	4	2	9	0	9	3	9	17	3	0
700	6	14	3	0		7	13	5	0	8	12	7	1	9	11	9	1	10	10	11	2	11	10	1	2
800	7	13	5	0		8	15	4	0	9	17	3	0	10	19	2	0	12	1	1	0	13	3	0	0
900	8	12	7	1		9	17	3	0	11	1	11	0	12	6	6	3	13	11	2	3	14	15	10	2
1000	9	11	9	1		10	19	2	2	12	6	6	3	13	13	11	2	15	1	4	1	16	8	9	0
ditto	l. 9.5889					l. 10.9587				l. 12.3286				l. 13.6984				l. 15.0682				l. 16.4379			

SIMPLE INTEREST at 5 per Cent.

	130 Days.				140 Days.				150 Days.				160 Days.				170 Days.				180 Days.					
Principal.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.		
1			4	1			4	2			4	3			5	1			5	2			5	3		
2			8	2			9	0			9	3			10	2			11	1			11	3		
3		1	0	3		1	1	3		1	2	3		1	3	3		1	4	3		1	5	3		
4		1	5	0		1	6	1		1	7	3		1	9	0		1	10	1		1	11	2		
5		1	9	1		1	11	0		2	0	2		2	2	1		2	4	0		2	5	2		
6		2	1	2		2	3	2		2	5	2		2	7	2		2	9	2		2	11	2		
7		2	5	3		2	8	1		2	10	2		3	0	3		3	3	1		3	5	2		
8		2	10	0		3	0	3		3	3	2		3	6	0		3	8	3		3	11	1		
9		3	2	2		3	5	1		3	8	1		3	11	1		4	2	1		4	5	1		
10		3	6	3		3	10	0		4	1	1		4	4	2		4	7	3		4	11	1		
20		7	1	2		7	8	0		8	2	2		8	9	0		9	3	3		9	10	1		
30		10	8	1		11	6	0		12	3	3		13	1	3		13	11	3		14	9	2		
40		14	3	0		15	4	0		16	5	1		17	6	1		18	7	2		19	8	3		
50		17	9	2		19	2	0		1	0	6	2	1	1	11	0		1	3	3	2	1	4	7	3
60	1	1	4	1	1	3	0	0		1	4	7	3	1	6	3	2		1	7	11	1	1	9	7	0
70	1	4	11	0	1	6	10	1		1	8	9	0	1	10	8	1		1	12	7	1	1	14	6	1
80	1	8	5	3	1	10	8	1		1	12	10	2	1	15	0	3		1	17	3	0	1	19	5	1
90	1	12	0	2	1	14	6	1		1	16	11	3	1	19	5	2		2	1	11	0	2	4	4	2
100	1	15	7	1	1	18	4	1		2	1	1	0	2	3	10	0		2	6	6	3	2	9	3	3
200	3	11	2	3	3	16	8	2		4	2	2	1	4	7	8	0		4	13	1	3	4	18	7	2
300	5	6	10	0	5	15	0	3		6	3	3	2	6	11	6	0		6	19	8	2	7	7	11	1
400	7	2	5	2	7	13	5	0		8	4	4	2	8	15	4	0		9	6	3	2	9	17	3	0
500	8	18	0	3	9	11	9	1		10	5	5	3	10	19	2	0		11	12	10	2	12	6	6	3
600	10	13	8	1	11	10	1	2		12	6	6	3	13	3	0	0		13	19	5	2	14	15	10	2
700	12	9	3	3	13	8	5	3		14	7	8	0	15	6	10	1		16	6	0	1	17	5	2	2
800	14	4	11	0	15	6	10	0		16	8	9	0	17	10	8	1		18	12	7	1	19	14	6	0
900	16	0	6	2	17	5	2	1		18	9	10	1	19	14	6	1		20	19	2	0	22	3	10	0
1000	17	16	1	3	19	3	6	2		20	10	11	2	21	18	4	1		23	5	9	0	24	13	1	3
ditto	l. 17.8078				l. 19.1776				l. 20.5479				l. 21.9177				l. 23.2875				l. 24.6573					

SIMPLE INTEREST at 5 per Cent.

Principal.	190 Days.				200 Days.				210 Days.				220 Days.				230 Days.				240 Days.			
	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.
1			6	1			6	2			7	0			7	1			7	2			7	3
2		1	0	2		1	1	0		1	1	3		1	2	2		1	3	0		1	3	3
3		1	6	3		1	7	3		1	8	3		1	9	2		1	10	3		1	11	3
4		2	1	0		2	2	1		2	3	2		2	5	0		2	6	1		2	7	2
5		2	7	1		2	8	3		2	10	2		3	0	1		3	1	3		3	3	2
6		3	1	2		3	3	2		3	5	2		3	7	2		3	9	1		3	11	1
7		3	7	3		3	10	0		4	0	1		4	2	2		4	5	0		4	7	1
8		4	2	0		4	4	2		4	7	1		4	9	3		5	0	2		5	3	0
9		4	8	1		4	11	1		5	2	1		5	5	0		5	8	0		5	11	0
10		5	2	2		5	5	3		5	9	0		6	0	1		6	3	2		6	7	0
20		10	5	0		10	11	2		11	6	0		12	0	2		12	7	1		13	1	3
30		15	7	1		16	5	1		17	3	0		18	1	0		18	10	3		19	8	2
40	1	0	9	3	1	1	11	0	1	3	0	0	1	4	1	1	1	5	2	2	1	6	3	2
50	1	6	0	1	1	7	4	3	1	8	9	0	1	10	1	3	1	11	6	0	1	12	10	2
60	1	11	2	3	1	12	10	2	1	14	6	1	1	16	2	0	1	17	9	2	1	19	5	2
70	1	16	5	1	1	18	4	1	2	0	3	1	2	2	2	1	2	4	1	1	2	6	0	1
80	2	1	7	3	2	3	10	0	2	6	0	1	2	8	2	2	2	10	5	0	2	12	7	1
90	2	6	10	1	2	9	3	3	2	11	9	1	2	14	3	0	2	16	8	2	2	19	2	0
100	2	12	0	2	2	14	9	2	2	17	6	2	3	0	3	1	3	3	0	0	3	5	9	0
200	5	4	1	1	5	9	7	0	5	15	0	3	6	0	6	2	6	6	0	1	6	11	6	0
300	7	16	2	0	8	4	4	3	8	12	7	1	9	0	9	3	9	9	0	2	9	17	3	0
400	10	8	2	2	10	19	2	1	11	10	1	1	12	1	1	1	12	12	0	2	13	3	0	0
500	13	0	3	1	13	13	11	3	14	7	8	0	15	1	4	2	15	15	0	3	16	8	9	1
600	15	12	4	0	16	8	9	1	17	5	2	2	18	1	7	3	18	18	1	0	19	14	6	1
700	18	4	4	2	19	3	6	3	20	2	8	3	21	1	11	0	22	1	1	0	23	0	3	1
800	20	16	5	1	21	18	4	1	23	0	3	1	24	2	2	1	25	4	1	1	26	6	0	1
900	23	8	5	3	24	13	1	3	25	17	9	2	27	2	5	2	28	7	1	2	29	11	9	1
1000	26	0	6	2	27	7	11	1	28	15	4	0	30	2	8	3	31	10	1	2	32	17	6	1
ditto	l. 26.0271				l. 27.3969				l. 28.7671				l. 30.1368				l. 31.5067				l. 32.8765			

SIMPLE INTEREST at 5 per Cent.

Principal. l.	250 Days.				260 Days.				270 Days.				280 Days.				290 Days.				300 Days.			
	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.
1			8	1			8	2			8	3			9	1			9	2			9	3
2		1	4	2		1	5	0		1	5	3		1	6	2		1	7	0		1	7	3
3		2	0	3		2	1	3		2	2	2		2	3	2		2	4	2		2	5	2
4		2	8	3		2	10	1		2	11	2		3	0	3		3	2	1		3	3	2
5		3	5	1		3	6	3		3	8	1		3	10	0		3	11	3		4	1	1
6		4	1	1		4	3	1		4	5	1		4	7	1		4	9	0		4	11	1
7		4	9	2		4	11	3		5	2	1		5	4	2		5	6	3		5	9	0
8		5	5	3		5	8	2		5	11	0		6	1	2		6	4	1		6	7	0
9		6	2	0		6	5	0		6	7	3		6	11	0		7	1	3		7	4	3
10		6	10	0		7	1	2		7	4	3		7	8	0		7	11	1		8	2	2
20		13	8	2		14	3	0		14	9	2		15	4	0		15	10	3		16	5	1
30	1	0	6	2	1	1	4	2	1	2	2	1	1	3	0	0	1	3	10	0	1	4	8	0
40	1	7	4	3	1	8	5	3	1	9	7	0	1	10	8	1	1	11	9	1	1	12	10	2
50	1	14	3	0	1	15	7	1	1	16	11	3	1	18	4	1	1	19	8	3	2	1	10	
60	2	1	1	0	2	2	8	3	2	4	4	2	2	6	0	1	2	7	8	0	2	9	3	3
70	2	7	11	1	2	9	10	1	2	11	9	1	2	13	8	2	2	15	7	1	2	17	6	2
80	2	14	9	2	2	16	11	3	2	19	2	0	3	1	4	1	3	3	6	3	3	5	9	0
90	3	1	7	3	3	4	1	1	3	6	7	0	3	9	0	2	3	11	6	0	3	13	11	3
100	3	8	5	3	3	11	2	3	3	13	11	3	3	16	8	2	3	19	5	2	4	2	2	1
200	6	16	11	3	7	2	5	2	7	7	11	1	7	13	5	0	7	18	10	3	8	4	4	2
300	10	5	5	3	10	13	8	2	11	1	11	0	11	10	1	2	11	18	4	1	12	6	6	3
400	13	13	11	2	14	4	11	1	14	15	10	2	15	6	10	1	15	17	9	2	16	8	9	0
500	17	2	5	2	17	16	2	0	18	9	10	1	19	3	6	3	16	17	3	0	20	10	11	2
600	20	10	11	2	21	7	4	3	22	3	10	0	23	0	3	1	23	16	8	2	24	13	1	3
700	23	19	5	1	24	18	7	2	25	17	9	2	26	16	11	3	27	16	2	0	28	15	4	0
800	27	7	11	1	28	9	10	1	29	11	9	1	30	13	8	1	31	15	7	1	32	17	6	1
900	30	16	5	1	32	1	1	0	33	5	9	0	34	10	5	0	35	15	0	3	36	19	8	3
1000	34	4	11	1	35	12	4	0	36	19	8	3	38	7	1	2	39	14	6	1	41	1	11	0
ditto	l. 34.2466				l. 35.6164				l. 36.9862				l. 38.3561				l. 39.7259				l. 41.0957			

SIMPLE INTEREST at 5 per Cent.

	310 Days.	320 Days.	330 Days.	340 Days.	350 Days.	360 Days.	365 Days or 1 Year
prin- pal. l.	l. s. d. q.	l. s. d. q.	l. s. d. q.	l. s. d. q.	l. s. d. q.	l. s. d. q.	l. s.
1	10 0	10 2	10 3	11 1	11 2	11 3	1
2	1 8 1	1 9 0	1 9 3	1 10 1	1 11 0	1 11 3	2
3	2 6 2	2 7 2	2 8 2	2 9 2	2 10 2	2 11 2	3
4	3 4 3	3 6 0	3 7 1	3 8 3	3 10 0	3 11 1	4
5	4 3 0	4 4 2	4 6 1	4 7 3	4 9 2	4 11 1	5
6	5 1 0	5 3 0	5 5 0	5 7 0	5 9 0	5 11 0	6
7	5 11 1	6 1 2	6 4 0	6 6 1	6 8 2	6 10 3	7
8	6 9 2	7 0 0	7 2 3	7 5 2	7 8 0	7 10 3	8
9	7 7 3	7 10 3	8 1 2	8 4 2	8 7 2	8 10 2	9
10	8 6 0	8 9 0	9 0 2	9 3 3	9 7 0	9 10 1	10
20	16 11 3	17 6 1	18 1 0	18 7 2	19 2 0	19 8 3	1 0
30	1 5 5 3	1 6 3 2	1 7 1 2	1 7 11 1	1 8 9 0	1 9 7 0	1 10
40	1 13 11 3	1 15 5 3	1 16 2 0	1 17 3 0	1 18 4 1	1 19 5 2	2 0
50	2 2 5 2	2 3 10 0	2 5 2 2	2 6 6 3	2 7 11 1	2 9 3 3	2 10
60	2 10 11 2	2 12 7 1	2 14 3 0	2 15 10 2	2 17 6 1	2 19 2 1	3 0
70	2 19 5 2	3 1 4 1	3 3 3 2	3 5 2 2	3 7 1 2	3 9 0 2	3 10
80	3 7 11 1	3 10 1 2	3 12 4 0	3 14 6 1	3 16 8 2	3 18 10 3	4 0
90	3 16 5 1	3 18 10 3	4 1 4 2	4 3 10 0	4 6 3 2	4 8 9 0	4 10
100	4 4 11 1	4 7 8 0	4 10 5 0	4 13 1 3	4 15 10 2	4 18 7 2	5
200	8 9 10 1	8 15 4 0	9 0 9 3	9 6 3 2	9 11 9 1	9 17 3 0	10
300	12 14 9 2	13 3 0 0	13 11 2 3	13 19 5 1	14 7 8 0	14 15 10 3	15
400	16 19 8 3	17 10 8 1	18 1 7 3	18 12 7 0	19 3 6 3	19 14 6 1	20
500	21 4 7 3	21 18 4 1	22 12 0 2	23 5 9 0	23 19 5 1	24 13 1 3	25
600	25 9 7 0	26 6 0 1	27 2 5 2	27 18 10 3	28 15 4 0	29 11 9 1	30
700	29 14 6 1	30 13 8 1	31 12 10 2	32 12 0 2	33 11 2 3	34 10 5 0	35
800	33 19 5 1	35 1 4 1	36 3 3 2	37 5 2 2	38 7 1 2	39 9 0 2	40
900	38 4 4 2	39 9 0 1	40 13 8 1	41 18 4 1	43 3 0 0	44 7 8 0	45
1000	42 9 3 3	43 16 8 2	45 4 1 1	46 11 6 0	47 18 10 3	49 6 3 2	50
1100	l. 42.4655	l. 43.8353	l. 45.2051	l. 46.5749	l. 47.9447	l. 49.3150	l. 50

A TABLE shewing the Number of Days between any Day of one Month, and the same Day of any other.

Jan. 1, &c.	Febr.	March.	April.	May	June.
<i>Febr. 31.</i>	<i>Marc. 28.</i>	<i>April 31.</i>	<i>May 30.</i>	<i>June 31.</i>	<i>July 30.</i>
<i>Marc. 59.</i>	<i>April 59.</i>	<i>May 61.</i>	<i>June 61.</i>	<i>July 61.</i>	<i>Aug. 61.</i>
<i>April 90.</i>	<i>May 89.</i>	<i>June 92.</i>	<i>July 91.</i>	<i>Aug. 92.</i>	<i>Sept. 92.</i>
<i>May 120.</i>	<i>June 120.</i>	<i>July 122.</i>	<i>Aug. 122.</i>	<i>Sept. 123.</i>	<i>Oct. 122.</i>
<i>June 151.</i>	<i>July 150.</i>	<i>Aug. 153.</i>	<i>Sept. 153.</i>	<i>Oct. 153.</i>	<i>Nov. 153.</i>
<i>July 181.</i>	<i>Aug. 181.</i>	<i>Sept. 184.</i>	<i>Oct. 183.</i>	<i>Nov. 184.</i>	<i>Dec. 183.</i>
<i>Aug. 212.</i>	<i>Sept. 212.</i>	<i>Oct. 214.</i>	<i>Nov. 214.</i>	<i>Dec. 214.</i>	<i>Jan. 214.</i>
<i>Sept. 243.</i>	<i>Oct. 242.</i>	<i>Nov. 245.</i>	<i>Dec. 244.</i>	<i>Jan. 245.</i>	<i>Feb. 245.</i>
<i>Oct. 273.</i>	<i>Nov. 273.</i>	<i>Dec. 275.</i>	<i>Jan. 275.</i>	<i>Feb. 276.</i>	<i>Mar. 273.</i>
<i>Nov. 304.</i>	<i>Dec. 303.</i>	<i>Jan. 306.</i>	<i>Feb. 306.</i>	<i>Mar. 304.</i>	<i>Apr. 304.</i>
<i>Dec. 334.</i>	<i>Jan. 334.</i>	<i>Feb. 337.</i>	<i>Mar. 334.</i>	<i>Apr. 335.</i>	<i>May 334.</i>
<i>Jan. 365.</i>	<i>Feb. 365.</i>	<i>Mar. 365.</i>	<i>Apr. 365.</i>	<i>May 365.</i>	<i>June 365.</i>
July.	August.	Septemb.	October.	Novemb.	Decemb.
<i>Aug. 31.</i>	<i>Sept. 31.</i>	<i>Octob. 30.</i>	<i>Nov. 31.</i>	<i>Dec. 30.</i>	<i>Jan. 31.</i>
<i>Sept. 62.</i>	<i>Octob. 61.</i>	<i>Nov. 61.</i>	<i>Dec. 61.</i>	<i>Jan. 61.</i>	<i>Febr. 62.</i>
<i>Oct. 92.</i>	<i>Nov. 92.</i>	<i>Dec. 91.</i>	<i>Jan. 92.</i>	<i>Febr. 92.</i>	<i>Mar. 90.</i>
<i>Nov. 123.</i>	<i>Dec. 122.</i>	<i>Jan. 122.</i>	<i>Feb. 123.</i>	<i>Mar. 120.</i>	<i>Apr. 121.</i>
<i>Dec. 153.</i>	<i>Jan. 153.</i>	<i>Feb. 153.</i>	<i>Mar. 151.</i>	<i>Apr. 151.</i>	<i>May 151.</i>
<i>Jan. 184.</i>	<i>Feb. 184.</i>	<i>Mar. 181.</i>	<i>Apr. 182.</i>	<i>May 181.</i>	<i>June 182.</i>
<i>Feb. 215.</i>	<i>Mar. 212.</i>	<i>Apr. 212.</i>	<i>May 212.</i>	<i>June 212.</i>	<i>July 212.</i>
<i>Mar. 243.</i>	<i>Apr. 243.</i>	<i>May 242.</i>	<i>June 243.</i>	<i>July 242.</i>	<i>Aug. 243.</i>
<i>Apr. 274.</i>	<i>May 273.</i>	<i>June 273.</i>	<i>July 273.</i>	<i>Aug. 273.</i>	<i>Sept. 274.</i>
<i>May 304.</i>	<i>June 304.</i>	<i>July 303.</i>	<i>Aug. 304.</i>	<i>Sept. 304.</i>	<i>Oct. 304.</i>
<i>June 335.</i>	<i>July 334.</i>	<i>Aug. 334.</i>	<i>Sept. 335.</i>	<i>Oct. 334.</i>	<i>Nov. 335.</i>
<i>July 365.</i>	<i>Aug. 365.</i>	<i>Sept. 365.</i>	<i>Oct. 365.</i>	<i>Nov. 365.</i>	<i>Dec. 365.</i>

Sect.8. Use of the Tables of Simple Interest. 185

The Use of the foregoing Tables.

1. This Table last above I shall first shew the Use of, because it is naturally in Use before that of Simple Interest.

Example.] How many Days is contained between the 19th of November and the 28th of March following?

Rule.] This Table shews, that from November (19, &c.) to the same Day of March, it is 120 Days. To which adding the Days that 28 exceeds nineteen, viz. 9, gives 129 Days for Answer. But in case the Days you reckon to, are not so many as those you reckon from; then subtract the difference. As, to find the Days between the 28th of November and the 19th of March; November 28, &c. to the same Day of March is 120 Days (as before) from which deducting what 28 exceeds the 19th of November, and the Remainder is 111 Days the Answer.

The Use of the Table of Simple Interest, at 5 per Cent.

Example 1.] What is the Interest of £.700 from the 5th of July to the 13th of April following, at 5 per Cent?

The time is 282 Days, and against £.700 under } £. 26 : 16 : 11 $\frac{3}{4}$
280 Days, is

And under 2 Days is — : 3 : 10

Example 2.] To find the Interest of £.470 from the 18th of December to the 5th of April, at 5 per Cent. The Days. *Ans.* £. 27 : — : 9 $\frac{3}{4}$

Time is 108 Days; and £.400, under 100 = £. 5 : 9 : 7

£.70, under 100 = — : 19 : 2

£.400, under 8 = — : 8 : 9 $\frac{3}{4}$

£.70, under 8 = — : 1 : 6

3. Or any more odd or larger Sums in Questions of this kind may be multiplied one in another, and the Product of the Days and Pounds by the

00013699 at the beginning of the Table of 5 per Cent. for Answer.

4. If you would find the Interest of £.4700 (or other Sum above 1000) for 108, &c. Days; under 100 Days and 8 Days against ditto you find the marginal Numbers, whose Sum being multiplied by 4.7 (= 4700) gives the Answer £. 69 : 10 : 7 $\frac{1}{2}$.

Against ditto under 100 is 13.6984
under 8 is 1.0956

Sum £.14.7940
Multiply by 4.7

Product Answ. = 69.5318
Such

186 Use of the Tables of Simple Interest. Chap. 3.

Such Persons as are minded to have an Instrument whereby to find the Number of Days between any two in the Year, may see the Form of one, *Plate A. Fig. 25*, and 26. which being done in Brass, and of a six-inch Radius, will most easily and accurately answer their End.

The Description and Use of the Circles of Days and Months, (*Fig. 25, 26. Plate A.*)

This consists of a Circle (as *Fig. 26.*) divided into 365 Days, which is to turn round concentrically in a Circle, (*Fig. 25.*) divided into the Months in the Year, and each Month into its respective Days: so that the inner Circle naturally measures the Days between any two in any of the Months, in order to find the Interest or Discount for those Days.

Example.] How many Days are contained between the 15th of November and the 2d of May following?

For Answer, turn the Hand in the inner Circle to the 15th of November in the outer Circle, and against the 2d of May in that outer, you will find in the inner Circle 168 Days, including the Day you reckon from, and excluding that which you reckon to.

Rules how by the two Tables of 4 and 5 per Cent. above, to find the Interest at any Rate from 1 to 10 per Cent. inclusive, very easily and briefly.

For instance, *l. 500* for 170 Days.

Rules.

Examples.

For 1 per Cent. take a fourth } *l. 9 : 6 : 3 : 3* } of which $\frac{1}{4}$ is } *l. 2 : 6 : 6 $\frac{3}{4}$* Answer.
of the Int. at 4 per Cent. }
2 per Cent. take half the } *l. 9 : 6 : 3 : 3* ; $\frac{1}{2}$ is 4 : 13 : 1 $\frac{3}{4}$ Answer.
Interest at 4 per Cent. }
3 per Cent. is the Interest } *l. 2 : 6 : 6 : 3 = 6 : 19 : 9* Answer.
at 4 per Cent. less a 4th }
thereof, as less — }
6 per Cent. is the Interest }
at 4 per Cent. more half } *9 : 6 : 3 : 3* }
thereof — } } or 13 : 19 : 5 $\frac{1}{2}$ Answ.
more 4 : 13 : 1 : 3 }
7 per C. take }
the Int. of 1 p.C. } as 8 p.C. is = *18 : 12 : 7 : 2* }
from the Int. of } 1 p.C. less = *2 : 6 : 6 : 3* gives } *16 : 6 : — $\frac{3}{4}$* Anf.
8 p.C. found thus }

Rules.

Rules.

Examples.

For 8 per Cent. add the Int. }
at 4 per Cent. to itself } $18:12:7:2 = 18:12:7\frac{1}{2}$ Answ.

4 per Cent. is $9:6:3:3$

9 per Cent. add the Int. at }
4 and 5 per C. together } Sum $20:19:2\frac{1}{4}$ Answ.

5 per Cent. is $11:12:10:2$

10 per Cent. add the Int. at }
5 per Cent. to itself — } $11:12:10:2$ } Sum $23:5:9$ Answ.
more $11:12:10:2$

II. The Use of Decimals in calculating Discount.

This matter wants very much to be set in a clear Light, for I have not yet seen it done; tho I have not perhaps seen all that has been wrote upon it: But I know that a learned Author in Folio has intirely mistaken it.

1. The *Discount* of Money is the Allowance made by the Creditor out of a Sum of Money due to him at the end of some number of Days, in consideration of the prompt Payment of the Remainder by the Debtor.

2. That Sum paid down instead of the Principal due hereafter, may properly be called *the present Worth*; in regard that if it were put out to Interest for the Days that the Discount is computed, it would amount to the Principal due at the end of those Days.

3. The Interest for any time is more than the Discount for that time; because (suppose of $l.1$ for 1 Day at 6 per Cent.) the Quotient must be more when $.016438$ (= the Interest of $l.100$ for one Day) is divided only by 100, than when it is divided by $l.100.016438$.

4. To find *the present Worth* of $l.1$. due 1 Day hence at 6 per Cent.

Days.	$l.$ Int.	Day.	$l.$ Int.
-------	-----------	------	-----------

1st, As 365.	6	::	1.	$.016438$
--------------	---	----	----	-----------

$l.$

$l.$

$l.$

$l.$ Answer.

2dly, As 100.	$.016438$.	100	::	1	$.99983565$
---------------	-------------	-----	----	---	-------------

5. For the Discount of $l.1$ for 1 Day.

1st, As 365.	6	::	1.	$.016438$
--------------	---	----	----	-----------

2dly, As 100.	$.016438$.	$.016438$::	1	to $.00016435$
---------------	-------------	-----------	----	---	----------------

Here the Sum of the present Worth and Discount makes up the Principal Sum Proof, $l.1.00000000$ payable at time, as a Proof of the Truth of both.

In the last Example, 365 in 100 is 36500, that in 1000 makes 36500000, without farther trouble; then 365 by 100 = 36500; more 90 Days in 6 (the Rate) is 540; and that Sum is = 37040, the Divisor. See the Work.

3704.0) 3650000.0 (985.42117 = the Answer,
or present Worth.

2. For *Discount*; Multiply the Rate in the Principal given, and that in the Days given is your Dividend. And the Product of 365 Days by 100 added to that of the Days, in the Rate given, is the Divisor. Thus the Principal in the Rate is

31640
2008.0
1560.0
784.0
432.0
616.0
2456.0

By the Days = 6000
By the Days = 90

And 365 in 100 = 36500 | 3704.0) 54000.0 = Divd. (14.57883 = Discount, as before.
More 90 in 6 = 540

Divisor = 37040 Sum. |

16960
2144.0
2920.0
3272.0
3088.0
1248.0

Note, By this last Method you use fewer Figures by above 40, and have not a third of the trouble.

9. In *Dr. Harris's Lexicon* the Discount for one Day is asserted to be the 365th part of that for a Year: However this Mistake came, I know not; but his two Folio Pages of Table of Discount being made upon the same Principle, are likewise erroneous. And to prove this, it is sufficient from the foregoing due Calculation, That the Discount of *l.1* for 1 Day, at 6 per Cent. is .00016435, and not .0001550788, as the *Lexicon* makes it. And to pretend that multiplying the Discount of *l.1* for 1 Day, gives the Discount of one Pound for other Days by which you multiply, is a wrong Notion; because every Day's Discount of *l.1* differs, being less according as that Day is distant from 1, as appears plain from what follows.

This is a full Indication that one Day's Discount at the beginning of the Year is much more than at the middle or end: and therefore were the last Example above of the Discount of *l.* 1000 for 90 Days to be done by the Tables in the *Lexi-*

con, it would be } *l.*
but ————— } 13:19:1 $\frac{3}{4}$

Whereas 'tis in }
truth by the }
Calculation a- } 14:11:6 $\frac{3}{4}$
bove ————— }

So that the said *Lexicon-* Tables err in this Instance 12*s.* 5*d.* And were the Days fewer, for which the Discount is required, the Error would be proportionably greater.

Hence it may be inferred, That no Tables of Discount can be used with accuracy, but such as have the Discount for every Day in the Year, because every Day's Discount differeth. And had I time, and room in this Book, I would oblige the Publick with a Table of Discount for every Day, because I know not of any true Table of Discount extant. But in the mean time, the following will be better than any yet published, and will be found accurate enough in Practice.

Days.	Discount of 1. 1 for those Days at 6 per Cent.	Differences, or each Day's Discount.
1	.00016435	
2	.00032865	.00016430
3	.0004929	.00016425
4	.0006571	.0001642
180	.0287386	
181	.0288937	.0001551
182	.0290487	.0001550
183	.0292036	.0001549
362	.05616456	
363	.05631106	.00014642
364	.05645744	.00014638
365	.05660377	.00014633

A TABLE of DISCOUNT at 4 per Cent. per Ann.
more Accurate than any extant.

	1 Day.			2 Days.			3 Days.			4 Days.			5 Days.			6 Days.			7 Days.			8 Days.		
Prin- pal.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.
1																								
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
20																								
30																								
40																								
50																								
60																								
70																								
80																								
90																								
100																								
200																								
300																								
400																								
500																								
600																								
700																								
800																								
900																								
1000																								
ditto																								
	l. .10957			l. .21913			l. .32865			l. .43816			l. .54764			l. .6571			l. .76653			l. .87594		

A TABLE of DISCOUNT at 4 per Cent.

	9 Days.				10 Days.				20 Days.				30 Days.				40 Days.				50 Days.				60 Days.								
Principal.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.		
1			1				1				0	2			3			1	0			1	1					1	2				
2			2				2				1	0			1	2			2	0			2	2				3	1				
3			3				3				1	2			2	1			3	1			4	0				4	3				
4		1	0				1	0			2	1			3	1			4	1			5	1				6	1				
5		1	1				1	1			2	3			4	0			5	1			6	2				7	3				
6		1	2				1	2			3	1			4	3			6	1			7	3				9	2				
7		1	3				1	3			3	3			5	2			7	1			9	1				11	0				
8		2	0				2	1			4	1			6	1			8	1			10	2			1	0	2				
9		2	1				2	2			4	3			7	0			9	2			11	3			1	2	0				
10		2	2				2	3			5	1			7	3			10	2			1	1	0		1	3	3				
20		4	3				5	1			10	2			1	3	3		1	9	0		2	2	1		2	7	1				
30		7	0				7	3			1	3	3		1	11	3		2	7	2		3	3	1		3	11	0				
40		9	2				10	2			1	9	0		2	7	2		3	6	0		4	4	1		5	2	3				
50	1	0	0			1	1	0			2	2	1		3	3	1		4	4	2		5	5	1		6	6	2				
60	1	2	1			1	3	3			2	7	2		3	11	1		5	2	3		6	6	2		7	10	0				
70	1	4	2			1	6	1			3	0	3		4	7	0		6	1	1		7	7	2		9	1	3				
80	1	7	0			1	9	0			3	6	0		5	3	0		7	0	0		8	8	2		10	5	2				
90	1	9	1			1	11	3			3	11	1		5	10	3		7	10	1		9	9	3		11	9	0				
100	1	11	3			2	2	1			4	4	2		6	6	2		8	8	3		10	10	3		13	0	3				
200	3	11	2			4	4	2			8	9	0		13	1	1		17	5	2		1	1	9	2		1	6	1	2		
300	5	11	0			6	6	3			13	1	2		19	8	0		1	6	2	1	1	12	8	2		1	19	2	1		
400	7	10	3			8	9	0			17	6	0		1	6	2	2		1	14	11	0	2	3	7	1		2	12	3	0	
500	9	10	1			10	11	2			1	1	10	2		1	12	9	1		2	3	7	3	2	14	6	0		3	5	4	0
600	11	10	0			13	1	2			1	6	3	0		1	19	4	0		2	12	4	2	3	5	4	3		3	18	4	3
700	13	9	2			15	4	0			1	10	7	1		2	5	10	2		3	1	1	1	3	16	3	2		4	11	5	2
800	15	9	1			17	6	0			1	15	0	0		2	12	5	0		3	9	10	0	4	7	2	1		5	4	6	1
900	17	8	3			19	8	2			1	19	4	2		2	18	11	3		3	18	6	3	4	18	1	0		5	17	7	0
1000	19	8	2			1	1	10	3		2	3	8	3		3	5	6	2		4	7	3	2	5	9	0	0		6	10	7	3
ditto	L. 98532				L. 1.09469				L. 2.18699				L. 3.27689				L. 4.36443				L. 5.44959				L. 6.53239								

A TABLE of DISCOUNT at 4 per Cent. per Ann.

	70 Days.				80 Days.				90 Days.				100 Days.				110 Days.				120 Days.				
Principal.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	
1			1	3			2	0			2	1			2	3			3	0			3	1	
2			3	3			4	1			4	3			5	1			5	3			6	1	
3			4	2			6	1			7	0			7	3			8	2			9	1	
4			7	1			8	1			9	2			10	2			11	2		1	0	2	
5			9	1			10	2			11	3		1	1	0			1	2	1		1	3	2
6			11	0			1	0	2		1	2	0		1	3	3		1	5	1		1	6	3
7		1	0	3		1	2	2		1	4	2		1	6	1		1	8	0		1	9	3	
8		1	2	2		1	4	3		1	6	3		1	8	3		1	11	0		2	1	0	
9		1	4	2		1	6	3		1	9	0		1	11	2		2	1	3		2	4	0	
10		1	6	1		1	8	3		1	11	2		2	2	0		2	4	3		2	7	1	
20		3	0	2		3	5	3		3	11	0		4	4	1		4	9	1		5	2	1	
30		4	6	3		5	2	2		5	10	1		6	6	0		7	1	3		7	9	2	
40		6	1	0		6	11	2		7	9	3		8	8	0		9	6	1		10	4	3	
50		7	7	1		8	9	1		9	9	1		10	10	0		11	11	0		12	11	3	
60		9	1	2		10	5	1		11	8	3		13	0	0		14	3	2		15	7	0	
70		10	7	3		12	2	0		13	8	0		15	0	2		16	8	0		18	2	0	
80		12	2	1		13	11	0		15	7	2		17	4	1		19	0	2		1	0	9	1
90		13	8	2		15	7	3		17	7	0		19	6	1		1	1	5	2	1	3	4	2
100		15	2	3		17	4	3		19	6	2		1	1	8	1	1	3	10	0	1	5	11	2
200	1	10	5	2	1	14	9	1	1	19	0	3	2	3	4	2	2	7	7	3	2	11	11	1	
300	2	5	8	0	2	12	1	3	2	18	7	1	3	5	0	2	3	11	5	3	3	17	10	3	
400	3	0	11	0	3	9	6	1	3	18	1	2	4	6	8	3	4	15	3	2	5	3	10	1	
500	3	16	1	2	4	6	11	0	4	17	8	1	5	8	5	0	5	19	1	1	6	9	9	3	
600	4	11	4	1	5	4	3	2	5	17	2	2	6	10	1	0	7	2	11	1	7	15	9	1	
700	5	6	7	0	6	1	8	0	6	1	8	3	7	11	9	1	8	6	9	0	9	1	8	3	
800	6	1	9	3	6	19	0	3	7	16	3	1	8	13	5	2	9	10	7	0	10	7	8	1	
900	6	17	0	1	7	16	5	1	8	15	9	1	9	15	1	2	10	14	5	0	11	13	7	3	
1000	7	12	3	0	8	13	9	3	9	15	4	0	10	16	9	3	11	18	2	3	12	19	7	1	
ditto	l. 7.61283				l. 8.69092				l. 9.76668				l. 10.84011				l. 11.9112				l. 12.98				

A TABLE of DISCOUNT at 4 per Cent. per Ann.

	130 Days.				140 Days.				150 Days.				160 Days.				170 Days.				180 Days.					
Principal.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.		
1.																										
1			3	2			3	3			4	0			4	1			4	2			4	3		
2			6	3			7	1			7	3			8	1			8	3			9	1		
3			10	1			11	0			11	3		1	0	1		1	1	1		1	2	0		
4		1	1	2		1	2	2		1	2	2		1	4	2		1	5	2		1	6	2		
5		1	5	0		1	6	0		1	7	2		1	8	3		1	10	0		1	11	1		
6		1	8	1		1	9	3		1	11	1		2	0	3		2	2	2		2	4	0		
7		1	11	3		2	1	2		2	3	1		2	5	0		2	6	3		2	8	2		
8		2	3	0		2	5	0		2	7	0		2	9	0		2	11	1		3	1	0		
9		2	6	1		2	8	3		2	11	0		3	1	1		3	3	2		3	5	3		
10		2	9	3		3	0	1		3	2	3		3	5	2		3	7	3		3	10	2		
20		5	7	2		6	0	2		6	5	2		6	10	3		7	3	3		7	8	3		
30		8	5	1		9	0	3		9	8	2		10	4	1		10	11	3		11	7	1		
40		11	2	3		12	1	0		12	11	1		13	9	2		14	7	2		15	5	3		
50		14	0	2		15	1	1		16	2	0		17	2	3		18	3	2		19	4	1		
60		16	10	1		18	1	2		19	5	0		1	0	8	0	1	1	11	2	1	3	2	2	
70		19	8	0		1	1	2	0	1	2	7	3		1	4	1	2	1	5	7	1	1	7	1	0
80	1	2	5	3		1	4	2	1	1	5	10	2		1	7	6	3	1	9	3	1	1	10	11	2
90	1	5	3	2		1	7	2	2	1	9	1	1		1	11	0	1	1	12	11	1	1	14	9	3
100	1	8	1	0		1	10	2	3	1	12	4	1		1	14	5	3	1	16	7	0	1	18	8	1
200	2	16	2	1		3	0	5	2	3	4	8	1		3	8	11	1	3	13	1	3	3	17	4	2
300	4	4	3	1		4	10	8	1	4	17	0	2		5	3	4	3	5	9	8	3	5	16	0	3
400	5	12	4	2		6	0	11	0	6	9	4	3		6	17	10	1	7	6	3	3	7	14	9	0
500	7	0	5	2		7	11	1	2	8	1	8	3		8	12	4	0	9	2	10	3	9	13	5	2
600	8	8	6	3		9	1	4	1	9	14	0	3		10	6	9	2	10	19	5	3	11	12	1	2
700	9	16	7	3		10	11	7	0	11	6	5	0		12	1	3	0	12	16	0	2	13	10	10	0
800	11	4	9	0		12	1	9	3	12	8	9	1		13	15	8	2	14	12	7	2	15	9	6	0
900	12	12	10	0		13	12	0	2	14	11	1	1		15	10	2	0	16	9	2	2	17	8	2	2
1000	14	0	11	1		15	2	3	1	16	3	5	2		17	4	7	3	18	5	9	2	19	6	10	3
ditto	l. 14.04646				l. 15.11333				l. 16.17251				l. 17.23209				l. 18.2894				l. 19.34444					

A TABLE of DISCOUNT at 4 per Cent. per Ann.

	190 Days.				200 Days.				210 Days.				220 Days.				230 Days.				240 Days.				
Principal.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	
1			5	0			5	1			5	2			5	3			6	0			6	1	
2			9	3			10	1			10	3			11	2			1	0	0		1	0	1
3		1	2	3		1	3	2		1	4	1		1	5	0		1	5	3		1	6	2	
4		1	7	2		1	8	2		1	9	2		1	10	3		1	11	3		2	0	2	
5		2	0	2		2	1	3		2	3	0		2	4	1		2	5	2		2	6	3	
6		2	5	2		2	6	3		2	8	1		2	10	0		2	11	2		3	1	0	
7		2	10	1		3	0	0		3	1	3		3	3	2		3	5	2		3	7	0	
8		3	3	1		3	5	1		3	7	1		3	9	1		3	11	1		4	1	1	
9		3	8	0		3	10	2		4	0	2		4	2	3		4	5	1		4	7	1	
10		4	1	0		4	3	2		4	6	0		4	8	2		4	11	0		5	1	2	
20		8	2	0		8	7	0		9	0	0		9	5	0		9	10	0		10	3	0	
30		12	2	3		12	10	2		13	6	0		14	1	2		14	9	0		15	4	2	
40		16	3	3		17	2	0		18	9	0		18	10	0		19	8	0		1	0	6	0
50	1	0	4	3	1	1	5	1	1	2	6	0	1	3	6	2	1	4	7	0	1	5	7	2	
60	1	4	5	3	1	5	8	3	1	7	0	0	1	8	3	0	1	9	6	0	1	10	9	0	
70	1	8	6	3	1	10	0	1	1	11	6	0	1	12	11	2	1	14	5	0	1	15	10	2	
80	1	12	7	2	1	14	3	3	1	16	0	0	1	17	8	0	1	19	4	0	2	1	0	0	
90	1	16	8	2	1	18	7	1	2	0	6	0	2	2	4	2	2	4	3	0	2	6	1	2	
100	2	0	9	2	2	2	10	3	2	5	0	0	2	7	1	0	2	9	2	0	2	11	3	0	
200	4	1	7	0	4	5	9	2	4	9	11	3	4	14	2	0	4	18	4	1	5	2	6	0	
300	6	2	4	3	6	8	8	1	6	14	11	3	7	1	3	0	7	7	6	1	7	13	9	1	
400	8	3	2	0	8	11	7	0	8	19	11	3	9	8	4	0	9	16	8	2	10	5	0	0	
500	10	3	11	3	10	14	5	3	11	4	11	2	11	15	5	0	12	5	10	1	12	16	3	1	
600	12	4	9	1	12	17	4	2	13	9	11	2	14	2	6	0	14	15	0	1	15	7	6	1	
700	14	5	6	3	15	0	3	1	15	14	11	2	16	9	7	0	17	4	2	2	17	18	9	2	
800	16	6	4	1	17	3	2	0	17	19	11	1	18	16	8	0	19	13	4	2	20	10	0	2	
900	18	7	1	3	19	6	0	3	20	4	11	1	21	3	9	0	22	2	6	2	23	1	3	2	
1000	20	7	11	2	21	8	11	2	22	9	11	0	23	10	10	0	24	11	8	2	25	12	6	2	
ditto	l. 20.3972				l. 21.44772				l. 22.49598				l. 23.542				l. 24.58578				l. 25.62733				

A TABLE of DISCOUNT at 4 per Cent. per Ann.

Principal. l.	250 Days.				260 Day.				270 Days.				280 Days.				290 Days.				300 Days.			
	l.	s.	d.	q.	s.	l.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.
1			6	2			6	3			7	0			7	0			7	1			7	2
2		1	0	3		1	1	1		1	1	3		1	2	1		1	2	3		1	3	1
3		1	7	1		1	8	0		1	8	3		1	9	2		1	10	1		1	11	0
4		2	1	2		2	2	2		2	3	2		2	4	3		2	5	2		2	6	2
5		2	8	0		2	9	1		2	10	2		2	11	3		3	1	0		3	2	1
6		3	2	2		3	4	0		3	5	2		3	7	0		3	8	1		3	9	3
7		3	8	3		3	10	2		4	0	1		4	2	0		4	3	3		4	5	2
8		4	3	1		4	5	1		4	7	1		4	9	1		4	11	1		5	1	0
9		4	9	2		5	0	0		5	2	0		5	4	1		5	6	2		5	8	3
10		5	4	0		5	6	2		5	9	0		5	11	2		6	2	0		6	4	2
20		10	8	0		11	1	0		11	6	0		11	11	0		12	4	0		12	8	3
30		16	0	0		16	7	2		17	3	0		17	10	2		18	5	3		19	1	1
40	1	1	4	0	1	2	2	0	1	3	0	0	1	3	9	3	1	4	7	3	1	5	5	2
50	1	6	8	0	1	7	8	2	1	8	8	3	1	9	9	1	1	10	9	2	1	11	10	0
60	1	12	0	0	1	13	3	0	1	14	5	3	1	15	8	3	1	16	11	3	1	18	2	1
70	1	17	4	0	1	18	9	2	2	0	2	3	2	1	8	1	2	3	1	2	2	4	6	3
80	2	2	8	0	2	4	4	0	2	5	11	3	2	7	7	2	2	9	3	2	2	10	11	1
90	2	8	0	0	2	9	10	2	2	11	8	3	2	13	7	0	2	15	5	1	2	17	3	2
100	2	13	4	0	2	15	5	0	2	17	5	3	2	19	6	2	3	1	7	1	3	3	8	0
200	5	6	8	0	5	10	9	3	5	14	11	2	5	19	1	0	6	3	2	2	6	7	4	0
300	8	0	0	0	8	6	2	3	8	12	5	1	8	18	7	2	9	4	9	3	9	10	11	3
400	10	13	4	0	11	1	7	2	11	9	11	0	11	18	2	0	12	6	5	0	12	14	7	3
500	13	6	8	0	13	17	0	2	14	7	4	3	14	17	8	2	15	8	0	1	15	18	3	3
600	16	0	0	0	16	12	5	2	17	4	10	2	17	17	3	0	18	9	7	2	19	1	11	3
700	18	13	4	0	19	7	10	1	20	2	4	1	20	16	9	2	21	11	2	3	22	5	7	2
800	21	6	8	0	22	3	3	1	22	19	9	3	23	16	4	1	24	12	10	0	25	9	3	2
900	24	0	0	0	24	18	8	0	25	17	3	2	26	15	10	3	27	14	5	1	28	12	11	2
1000	26	13	4	0	27	14	1	0	28	14	9	1	29	15	5	1	30	16	0	2	31	16	7	1
ditto	l. 26.6 r				l. 27.70378				l. 28.73853				l. 29.77139				l. 30.8019				l. 31.83024			

A TABLE of DISCOUNT at 4 per Cent. per Ann.

	310 Days.				320 Day.				330 Days.				340 Days.				350 Days.				360 Days.				
Prin- cipal. l.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	
1			7	3			8	0			8	2			8	3			9	0			9	1	
2		1	3	3		1	4	2		1	4	3		1	5	1		1	5	3		1	6	1	
3		1	11	3		2	0	1		2	1	1		2	1	3		2	2	2		2	3	1	
4		2	7	2		2	8	2		2	9	2		2	10	2		2	11	2		3	0	2	
5		3	3	2		3	4	3		3	6	0		3	7	0		3	8	1		3	9	2	
6		3	11	2		4	0	3		4	2	1		4	3	3		4	5	1		4	6	3	
7		4	7	1		4	9	0		4	10	3		5	0	1		5	2	0		5	3	3	
8		5	3	1		5	5	1		5	7	0		5	9	0		5	11	0		6	0	3	
9		5	11	0		6	1	1		6	3	2		6	5	2		6	7	3		6	10	0	
10		6	6	3		6	9	1		6	11	3		7	2	1		7	4	3		7	7	0	
20		13	1	3		13	6	3		13	11	2		14	4	2		14	9	1		15	2	1	
30		19	8	2		1	0	4	0		1	0	11	1		1	1	6	3		1	2	9	1	
40		1	6	3	2		1	7	1	1		1	7	11	1		1	8	8	3		1	10	4	2
50		1	12	10	2		1	13	10	3		1	14	11	0		1	15	11	0		1	17	11	2
60		1	19	5	1		2	0	7	3		2	1	10	3		2	3	1	1		2	5	6	2
70		2	6	0	0		2	7	5	1		2	8	10	2		2	10	3	2		2	13	1	3
80		2	12	7	0		2	14	2	2		2	15	10	1		2	17	5	3		2	19	1	1
90		2	19	1	3		3	0	11	3		3	2	10	0		3	4	8	0		3	8	4	0
100		3	5	8	3		3	7	9	1		3	9	9	3		3	11	10	1		3	15	11	0
200		6	11	5	2		6	15	6	1		6	19	7	1		7	3	8	1		7	11	9	3
300		9	17	2	0		10	3	3	2		10	9	5	0		10	15	6	1		11	7	8	3
400		13	2	11	0		13	11	0	2		13	19	2	2		14	7	4	2		14	15	6	1
500		16	8	7	2		16	18	9	3		17	9	0	1		17	19	2	2		18	9	4	3
600		19	14	4	1		20	6	6	3		20	18	10	0		21	11	0	3		22	3	3	1
700		23	0	1	0		23	14	4	0		24	8	7	2		25	2	11	0		25	17	1	3
800		26	5	9	3		27	2	1	0		27	18	5	1		28	14	9	0		29	11	0	1
900		29	11	6	1		30	9	10	1		31	8	2	3		32	6	7	0		33	4	11	0
1000		32	17	3	1		33	17	7	1		34	18	0	2		35	18	5	1		36	18	9	2
ditto		l. 32.86275					l. 33.88038					l. 34.90216					l. 35.92181					l. 36.93931			
																						l. 37.95466			

Discount at
4 per Cent.

Part II. For Days under 10 in a Medium, to add at above 90 Days.

Principal. l.	365 Days, or 1 Year.			
	l.	s.	d.	q.
1			9	1
2		1	6	2
3		2	3	3
4		3	1	0
5		3	10	1
6		4	7	1
7		5	4	3
8		6	1	3
9		6	11	1
10		7	8	1
20		15	4	3
30	1	3	1	0
40	1	10	9	1
50	1	18	5	2
60	2	6	1	3
70	2	13	10	1
80	3	1	6	2
90	3	9	2	3
100	3	16	11	1
200	7	13	10	1
300	11	10	9	1
400	15	7	8	1
500	19	4	7	1
600	23	1	6	2
700	26	18	5	2
800	30	15	4	3
900	34	12	3	3
1000	38	9	2	3
ditto	l. 38.46154			

1 Day.			2 Days.			3 Days.			4 Days.		
s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.
								1			1
					1			1			1
					1			1			1
					1			1			2
		1			1			2			2
		1			1			2			3
		1			2			2			3
		1			2			3		1	0
		1			2			3		1	0
		2		1	0		1	2		2	0
		3			1		2	1		3	0
	1	0			2		3	0		4	0
	1	1			2		3	3		5	0
	1	2			3		4	2		6	0
	1	3			3		5	1		7	0
	2	0			4		6	0		8	0
	2	1			4		6	3		9	0
	2	2			5		7	2		10	0
	5	0		1	0	1	3	0	1	8	0
	7	2	1	3	0	1	10	3	2	6	0
	10	0	1	8	0	2	6	0	3	4	1
1	0	2	2	1	0	3	1	3	4	2	1
1	3	0	2	6	0	3	9	1	5	0	1
1	5	2	2	11	1	4	4	3	5	10	1
1	8	0	3	4	1	5	0	1	6	8	1
1	10	3	3	9	1	5	7	3	7	6	2
2	1	1	4	2	1	6	3	2	8	4	2
l. 10467			l. 09352			l. 31401			l. 41868		

Part II. For Days under 10 in a Medium,
to add at above 90 Days:

	5 Days.			6 Days.			7 Days.			8 Days.			9 Days.		
Principal.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.
1						1			1			1			1
2			1			1			1			1			2
3			1			2			2			2			3
4			2			2			3			3		1	0
5			2			3			3		1	0		1	1
6			3		1	0			1	0		1	1		1
7			3		1	0			1	1		1	2		1
8		1	0		1	1			1	2		1	2		1
9		1	1		1	1			1	2		1	3		2
10		1	1		1	2			1	3		2	0		2
20		2	2		3	0			3	2		4	0		4
30		3	3		4	2			5	1		6	0		6
40		5	1		6	0			7	0		8	0		9
50		6	1		7	2			8	3		10	0		11
60		7	2		9	0		10	2		1	0	0		1
70		8	3		10	2		1	0	1		1	2	0	1
80		10	0		1	0	0		1	2	0		1	3	3
90		11	2		1	1	2		1	3	3		1	6	0
100		1	0	0		1	3	0		1	5	2		1	8
200	2	1	0		2	6	0		2	11	1		3	9	1
300	3	1	3		3	9	1		4	4	3		5	7	3
400	4	2	1		5	0	1		5	10	2		6	6	2
500	5	2	3		6	3	2		7	4	0		8	5	0
600	6	3	2		7	6	2		8	9	2		10	3	3
700	7	4	0		8	9	2		10	3	0		11	2	1
800	8	4	2		10	0	2		11	8	3		13	0	3
900	9	5	0		11	3	3		13	2	1		15	11	2
1000	10	5	2		12	6	3		14	7	3		16	10	0
ditto	l. 52335			l. 62852			l. 73269			l. 83737			l. 94204		

A TABLE of DISCOUNT at 5 per Cent. per Ann.

Principal. l.	1 Day.			2 Days.			3 Days.			4 Days.			5 Days.			6 Days.			7 Days.		
	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.
1																		1			1
2									1			1			1			1			2
3						1			1			1			2			2			3
4						1			1			2			2			3			3
5						1			2			2			3			1	0		1
6			1			1			2			3			1	0		1	1		1
7			1			2			3			3			1	1		1	1		1
8			1			2			3			1	0		1	1		1	2		1
9			1			2			3			1	1		1	2		1	3		2
10			1			3			1	0		1	1		1	3		2	0		2
20			3			1	1		2	0		2	3		3	1		4	0		4
30			1	0		2	0		3	0		4	0		5	0		5	3		6
40			1	1		2	2		4	0		5	1		6	2		7	3		9
50			1	3		3	1		5	0		6	2		8	1		9	3		11
60			2	0		4	0		6	0		7	3		10	0		11	3		1
70			2	1		4	3		6	3		9	1		11	2		1	1	3	1
80			2	3		5	1		7	3		10	2		1	1	0	1	3	3	1
90			3	0		6	0		8	3		11	3		1	2	3	1	5	3	1
100			3	1		6	2		9	3		1	1	0	1	4	2	1	7	3	1
200			6	2		1	1	0	1	7	3	2	2	1	2	8	3	3	3	2	3
300			10	0		1	7	3	2	5	3	3	3	2	4	1	1	4	11	0	5
400	1		1	1		2	2	1	3	3	2	4	4	3	5	5	3	6	6	3	7
500	1		4	2		2	8	3	4	1	1	5	5	3	6	10	0	8	2	2	9
600	1		7	3		3	3	2	4	11	1	6	6	3	8	2	2	9	10	1	11
700	1		11	0		3	10	0	5	9	0	7	8	0	9	7	0	11	6	0	13
800	2		2	1		4	4	3	6	6	3	8	9	1	10	11	2	13	1	2	15
900	2		5	3		4	11	1	7	4	3	9	10	1	12	3	3	14	9	1	17
1000	2		8	3		5	5	3	8	2	2	10	11	2	13	8	1	16	5	1	19
ditto	l. .1369			l. .2739			l. .4108			l. .5476			l. .6848			l. .8212			l. .9579		

A TABLE of DISCOUNT at 5 per Cent. per Ann.

	8 Days.				9 Days.				10 Days.				20 Days.				30 Days.				40 Days.				
Principal.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	
l.																									
1			1				1				1				3			1	0				1	1	
2			2				2				2				1	1		2	0				2	2	
3			3				3				1	0			2	0		3	0				4	0	
4			1	0			1	1			1	1			2	3		4	0				5	1	
5			1	1			1	2			1	3			3	1		5	0				6	2	
6			1	2			1	3			2	0			4	0		6	0				7	3	
7			1	3			2	0			2	1			4	3		6	3				9	1	
8			2	0			2	1			2	3			5	1		7	3				10	2	
9			2	1			2	3			3	0			6	0		8	3				11	3	
10			2	3			3	0			3	1			6	2		9	3			1	1	0	
20			5	1			5	3			6	2		1	1	0		1	7	2		2	2	0	
30			7	3			8	3			10	0		1	7	2		2	5	2		3	3	1	
40			10	2			11	3		1	1	0		2	2	1		3	3	1		4	4	1	
50	1		1	0		1	2	3		1	4	2		2	8	3		4	1	0		5	5	1	
60	1		3	3		1	5	3		1	7	3		3	3	1		4	1	0		6	6	2	
70	1		6	1		1	8	3		1	11	0		3	10	0		5	8	3		7	7	2	
80	1		9	0		1	11	3		2	2	1		4	4	2		6	6	2		8	8	2	
90	1	1	1	3		2	2	2		2	5	2		4	11	0		7	4	2		9	9	3	
100	2		2	1		2	5	2		2	8	3		5	5	2		8	2	1		10	10	3	
200	4		4	2		4	11	0		5	5	3		10	11	1		16	4	2		1	1	9	2
300	6		6	3		7	4	3		8	2	2		16	4	3		1	4	6	3	1	12	8	1
400	8		9	0		9	10	1		10	11	2		1	1	10	1	1	12	9	0	2	3	7	0
500	10		11	2		12	3	3		13	8	0		1	7	4	0	2	0	11	0	2	14	6	0
600	13		1	2		14	9	1		16	5	0		1	12	9	2	2	9	1	1	3	5	5	0
700	15		4	0		17	2	3		19	1	3		1	18	3	0	2	17	3	2	3	16	3	3
800	17		6	0		19	8	2		1	1	10	3	2	3	8	2	3	5	5	3	4	7	2	1
900	19		8	2		1	2	2	0	1	4	7	2	2	9	2	1	3	13	8	0	4	18	1	0
1000	1	1	10	3		1	4	7	2	1	7	4	1	2	14	7	3	4	1	10	1	5	9	0	0
ditto	l. 1.0947				l. 1.2313				l. 1.3679				l. 2.7322				l. 4.0925				l. 5.4496				

A TABLE of DISCOUNT at 5 per Cent. per Ann.

	50 Days.				60 Days.				70 Days.				80 Days.				90 Days.				100 Days.			
Principal.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.
1			1	3			2	0			2	1			2	2			3	0			3	1
2			3	1			4	0			4	3			5	1			5	3			6	2
3			5	0			6	0			6	3			7	3			9	3			9	3
4			6	2			7	3			9	0			10	2			11	3		1	1	0
5			8	1			9	3			11	2		1	1	0		1	2	2		1	4	1
6			9	3			11	3		1	1	3		1	3	3		1	5	2		1	7	2
7		11	2		1	1	3		1	4	0		1	6	1		1	8	2		1	10	3	
8	1	1	0		1	3	3		1	6	1		1	8	3		1	11	2		2	2	0	
9	1	2	3		1	5	2		1	8	2		1	11	2		2	2	1		2	5	1	
10	1	4	2		1	7	2		1	10	3		2	2	0		2	5	1		2	8	2	
20	2	8	3		3	3	1		3	9	2		4	4	0		4	10	2		5	5	0	
30	4	1	0		4	10	3		5	8	1		6	6	0		7	3	3		8	1	2	
40	5	5	1		6	6	1		7	7	1		8	8	0		9	9	0		10	10	1	
50	6	9	3		8	1	3		9	6	0		10	10	0		12	2	1		13	6	2	
60	8	2	0		9	9	2		11	5	0		13	0	0		14	7	1		16	3	1	
70	9	6	1		11	5	0		13	3	2		15	2	0		17	0	2		18	11	3	
80	10	10	3		13	0	2		15	2	1		17	4	1		19	5	3		1	1	8	1
90	12	3	0		14	8	0		17	1	1		19	6	1		1	1	11	0	1	4	5	0
100	13	7	1		16	3	3		19	0	0		1	1	8	1	1	4	4	1	1	7	1	1
200	1	7	2	2	1	12	7	1	1	18	0	0	2	3	4	2	2	8	8	2	2	14	2	3
300	2	0	9	3	2	8	11	0	2	16	11	3	3	5	0	2	3	13	0	3	4	1	4	0
400	2	14	5	1	3	5	2	2	3	15	11	3	4	6	8	3	4	17	5	1	5	8	5	2
500	3	8	0	1	4	1	6	1	4	14	11	3	5	8	4	3	6	1	9	2	6	15	6	2
600	4	1	7	2	4	17	10	0	5	13	11	3	6	10	1	0	7	6	1	3	8	2	8	0
700	4	15	2	3	5	14	1	2	6	12	11	3	7	11	9	1	8	10	6	0	9	9	9	1
800	5	8	10	1	6	10	5	1	7	11	11	2	8	13	5	1	9	14	10	1	10	16	10	3
900	6	2	5	2	7	6	8	3	8	10	11	2	9	15	1	2	10	19	2	2	12	4	0	0
1000	6	16	0	3	8	3	0	2	9	9	11	2	10	16	9	3	12	3	7	0	13	10	1	1
ditto	l. 6.8027				l. 8.1521				l. 9.4976				l. 10.8401				l. 12.1786				l. 13.5			

A TABLE of DISCOUNT at 5 per Cent. per Ann.

	110 Days.				120 Days.				130 Days.				140 Days.				150 Days.				160 Days.				
Principal.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	
1			3	2			4	0			4	1			4	2			5	0			5	1	
2			7	0			7	3			8	2			9	0			9	3			10	1	
3			10	3			11	3		1	0	2		1	1	2		1	2	2		1	3	2	
4		1	2	1		1	2	2		1	4	3		1	6	0		1	7	1		1	8	2	
5		1	5	3		1	7	2		1	9	0		1	10	2		2	0	0		2	1	3	
6		1	9	1		1	11	2		2	1	1		2	3	1		2	5	0		2	6	3	
7		2	0	3		2	3	1		2	5	2		2	7	2		2	9	3		3	0	0	
8		2	4	2		2	7	0		2	9	2		3	0	0		3	2	3		3	5	1	
9		2	8	0		2	11	0		3	1	3		3	4	2		3	7	2		3	10	1	
10		2	11	3		3	2	3		3	6	0		3	9	1		4	0	1		4	3	2	
20		5	11	1		6	5	2		7	0	0		7	6	1		8	0	2		8	7	0	
30		8	11	0		9	8	2		10	6	0		11	3	2		12	1	0		12	10	2	
40		11	10	2		12	11	1		14	0	0		15	0	2		16	1	1		17	2	0	
50		14	10	1		16	2	0		17	6	0		18	9	3		1	0	1	2	1	1	5	2
60		17	9	3		19	5	0		1	1	0	0	1	2	7	0	1	4	2	0	1	5	8	3
70	1	0	9	2	1	2	7	3	1	4	6	0	1	6	4	1	1	8	2	1	1	10	0	1	
80	1	3	9	0	1	5	10	2	1	8	0	0	1	10	1	1	1	12	2	2	1	14	3	3	
90	1	6	8	3	1	9	1	1	1	11	6	0	1	13	10	2	1	16	3	0	1	18	7	1	
100	1	9	8	1	1	12	4	1	1	15	0	0	1	17	7	2	2	0	3	1	2	2	10	3	
200	2	19	4	3	3	4	8	1	3	9	11	3	3	15	3	1	4	0	6	2	4	5	9	2	
300	4	9	0	3	4	17	0	1	5	4	11	3	5	12	11	0	6	0	9	3	6	8	8	1	
400	5	18	9	0	6	9	4	3	6	19	11	3	7	10	6	2	8	1	0	3	8	11	7	0	
500	7	8	5	1	8	1	8	3	8	14	11	2	9	8	2	0	10	1	4	1	10	14	5	3	
600	8	18	1	2	9	14	0	3	10	9	11	2	11	5	9	3	12	1	7	1	12	17	4	2	
700	10	7	10	0	11	6	5	0	12	4	11	2	13	3	5	1	14	1	10	2	15	0	3	1	
800	11	17	6	1	12	18	9	1	13	19	11	2	15	1	1	0	16	2	1	3	17	3	2	0	
900	13	7	2	2	14	11	1	1	15	14	11	1	16	18	8	2	18	2	5	0	19	6	0	3	
1000	14	16	10	3	16	3	5	2	17	9	11	1	18	16	4	1	20	2	8	1	21	8	11	2	
	l. 14.8448				l. 16.1725				l. 17.4966				l. 18.8172				l. 20.1342				l. 21.4477				

A TABLE of DISCOUNT at 5 per Cent. per Ann.

Principal. l.	170 Days.				180 Days.				190 Days.				200 Days.				210 Days.				220 Days.			
	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.
1			5	2			5	3			6	0			6	2			6	3			7	0
2			11	0			11	2		1	0	0		1	0	3		1	1	2		1	2	0
3		1	4	2		1	5	1		1	6	1		1	7	1		1	8	1		1	9	0
4		1	10	0		1	11	0		2	0	1		2	1	2		1	2	3		2	4	1
5		2	3	1		2	5	0		2	6	2		2	8	1		1	9	2		2	11	0
6		2	8	3		2	10	3		3	0	2		3	2	2		3	4	2		3	6	1
7		3	2	1		3	4	2		3	6	3		3	8	3		3	11	0		4	1	1
8		3	7	3		3	10	1		4	0	3		4	3	1		4	5	3		4	8	1
9		4	1	0		4	4	0		4	6	3		4	9	3		5	0	1		5	3	1
10		4	6	3		4	9	3		5	1	0		5	4	0		5	7	0		5	10	1
20		9	1	1		9	7	2		10	1	3		10	8	0		11	2	1		11	8	2
30		13	7	3		14	5	1		15	2	3		16	0	0		16	9	1		17	6	2
40		18	2	2		19	3	0	1	0	3	2	1	1	4	0	1	2	4	2	1	3	5	0
50	1	2	9	0	1	4	0	3	1	5	4	2	1	6	8	0	1	7	11	3	1	9	3	0
60	1	7	3	3	1	8	10	2	1	10	5	2	1	12	0	0	1	13	6	3	1	15	1	1
70	1	11	10	0	1	13	8	1	1	15	6	1	1	17	4	0	1	19	1	3	2	0	11	2
80	1	16	5	0	1	18	6	0	2	0	7	0	2	2	8	0	2	4	9	0	2	6	9	3
90	2	0	11	2	2	3	3	3	2	5	8	0	2	8	0	0	2	10	4	0	2	12	8	0
100	2	5	6	1	2	8	1	2	2	10	8	3	2	13	4	0	2	15	11	1	2	18	6	0
200	4	11	0	1	4	16	3	0	5	1	5	2	5	6	8	0	5	11	10	1	5	17	0	1
300	6	16	6	2	7	4	4	3	7	12	2	2	8	0	0	0	8	7	9	1	8	15	6	2
400	9	2	0	3	9	12	6	1	10	2	11	1	10	13	4	0	11	3	8	2	11	14	0	2
500	11	7	7	0	12	0	7	3	12	13	8	0	13	6	8	0	13	19	7	2	14	12	6	2
600	13	13	1	0	14	8	9	1	15	4	5	0	16	0	0	0	16	15	6	3	17	11	0	3
700	15	18	7	1	16	16	10	3	17	15	1	3	18	13	4	0	19	11	5	3	20	9	7	0
800	18	4	1	2	19	5	0	1	20	5	10	2	21	6	8	0	22	7	2	2	23	8	1	0
900	20	9	7	3	21	13	1	3	22	16	7	1	24	0	0	0	25	3	4	0	26	6	7	0
1000	22	15	1	3	24	1	3	2	25	7	4	1	26	13	4	0	27	19	3	1	29	5	1	1
ditto	l. 22.7577				l. 24.06420				l. 25.36710				l. 26.6 r 1				l. 27.9627				l. 29.2553			

A TABLE of DISCOUNT at 5 per Cent. per Ann.

	230 Days.				240 Days.				250 Days.				260 Days.				270 Days.				280 Days.				
Principal.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	
1			7	1			7	2			8	0			8	1			8	2			8	3	
2		1	2	3		1	3	1		1	4	0		1	4	2		1	5	1		1	5	3	
3		1	10	0		1	11	0		1	11	3		2	0	3		2	1	3		2	2	2	
4		2	5	1		2	6	2		2	7	3		2	9	0		2	10	1		2	11	2	
5		3	0	3		3	2	1		3	3	3		3	5	1		3	6	3		3	8	1	
6		3	8	0		3	9	3		3	11	3		4	1	2		4	3	2		4	5	1	
7		4	3	1		4	5	2		4	7	2		4	9	3		5	0	0		5	2	0	
8		4	10	2		5	1	0		5	3	2		5	6	0		5	8	2		5	11	0	
9		5	6	0		5	8	3		5	11	2		6	2	1		6	5	0		6	7	3	
10		6	1	1		6	4	2		6	7	3		6	10	2		7	1	2		7	4	3	
20		12	2	2		12	8	3		13	3	0		13	9	0		14	3	1		14	9	1	
30		18	4	0		19	1	1		19	10	2		1	0	7	2	1	1	5	0	1	2	2	0
40	1	4	5	1	1	5	5	2	1	6	6	0	1	7	6	0	1	8	6	2	1	9	6	3	
50	1	10	6	2	1	11	10	0	1	13	1	1	1	14	4	3	1	15	8	0	1	16	11	1	
60	1	16	7	3	1	18	2	1	1	19	8	3	2	1	3	1	2	2	9	2	2	4	4	0	
70	2	2	9	1	2	4	6	3	2	6	4	1	2	8	1	3	2	9	11	1	2	11	8	2	
80	2	8	10	2	2	10	11	1	2	12	11	3	2	15	0	1	2	17	0	3	2	19	1	1	
90	2	14	11	3	2	17	3	2	2	19	7	1	3	1	11	0	3	4	2	2	3	6	6	0	
100	3	1	1	0	3	3	8	0	3	6	2	3	3	8	9	2	3	11	4	0	3	13	10	2	
200	6	2	2	0	6	7	4	0	6	12	5	2	6	17	6	3	7	2	8	0	7	7	9	0	
300	9	3	3	1	9	10	11	3	9	18	8	0	10	6	4	1	10	14	0	0	11	1	7	2	
400	12	4	4	2	12	14	7	3	13	4	10	3	13	15	1	2	14	5	4	0	14	15	6	0	
500	15	5	5	1	15	18	3	3	16	11	1	2	17	3	6	1	17	16	8	0	18	9	4	3	
600	18	6	6	2	19	1	11	2	19	17	4	1	20	12	8	1	21	8	0	0	22	3	3	1	
700	21	7	7	2	22	5	7	2	23	3	7	0	24	1	5	3	24	19	4	0	25	17	1	3	
800	24	8	8	2	25	9	3	2	26	9	9	2	27	10	3	1	28	10	8	0	29	11	0	1	
900	27	9	9	2	28	12	11	1	29	16	0	1	30	19	0	2	32	2	0	0	33	4	11	0	
1000	30	10	10	3	31	16	7	1	33	2	3	0	34	7	10	0	35	13	4	0	36	18	9	2	
ditto	l. 30.5444				l. 31.8302				l. 33.1125				l. 34.3915				l. 35.6671				l. 36.9393				

A TABLE of DISCOUNT at 5 per Cent. per Ann.

Principal. l.	290 Days.				300 Days.				310 Days.				320 Days.				330 Days.				340 Days.			
	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.
1			9	1			9	2			9	3			10	0			10	2			10	3
2		1	6	1		1	7	0		1	7	2		1	8	0		1	8	3		1	9	1
3		2	3	2		2	4	2		2	5	1		2	6	1		2	7	1		2	8	0
4		3	0	3		3	1	3		3	3	0		3	4	2		3	5	2		3	6	3
5		3	10	0		3	11	2		4	0	3		4	2	2		4	4	0		4	5	2
6		4	7	0		4	8	3		4	10	3		5	0	2		5	2	1		5	4	1
7		5	4	1		5	6	1		5	8	2		5	10	2		6	0	3		6	2	3
8		6	1	1		6	3	3		6	6	1		6	8	2		6	11	0		7	1	2
9		6	10	2		7	1	1		7	4	0		7	6	3		7	9	2		8	0	0
10		7	7	3		7	10	3		8	1	3		8	5	0		8	7	3		8	11	0
20		15	3	2		15	9	2		16	3	2		16	9	2		17	3	3		17	9	3
30	1	2	11	0	1	3	8	1	1	4	5	1	1	5	2	1	1	5	11	2	1	6	8	2
40	1	10	6	3	1	11	7	0	1	12	7	0	1	13	7	0	1	14	7	1	1	15	7	1
50	1	18	2	2	1	19	5	3	2	0	8	3	2	2	0	0	2	3	3	0	2	4	6	0
60	2	5	10	1	2	7	4	2	2	8	10	3	2	10	4	3	2	11	10	3	2	13	4	3
70	2	13	6	0	2	15	3	1	2	17	0	1	2	18	9	2	3	0	6	2	3	2	3	3
80	3	1	1	2	3	3	2	0	3	5	2	0	3	7	2	1	3	9	2	2	3	11	2	2
90	3	8	9	1	3	11	0	2	3	13	4	0	3	15	7	0	3	17	10	1	4	0	1	1
100	3	16	5	0	3	18	11	2	4	1	5	3	4	3	11	3	4	6	6	0	4	9	0	0
200	7	12	10	0	7	17	10	3	8	2	11	2	8	7	11	3	8	13	0	0	8	18	0	0
300	11	9	3	0	11	16	10	1	12	4	5	0	12	11	11	3	12	19	6	0	13	7	0	0
400	15	5	8	0	15	15	9	2	16	5	10	3	16	15	11	2	17	6	0	0	17	16	0	1
500	19	2	1	0	19	14	8	3	20	7	4	1	20	19	11	2	21	12	6	0	22	5	0	1
600	22	18	6	0	23	13	8	1	24	8	10	0	25	3	11	1	25	19	0	0	26	14	0	1
700	26	14	11	0	27	12	7	2	28	10	3	3	29	7	11	0	30	5	6	0	31	3	0	2
800	30	11	4	0	31	11	7	0	32	11	9	1	33	11	11	0	34	12	0	0	35	12	0	2
900	34	7	9	0	35	10	6	1	36	13	3	0	37	15	11	0	38	18	6	0	40	1	0	2
1000	38	4	2	0	39	9	5	3	40	14	8	2	41	19	10	3	43	5	0	0	44	10	0	2
ditto	l. 38.2081				l. 39.4736				l. 40.7358				l. 41.9947				l. 43.2503				l. 44.5026			

Discount at 5 per Cent.

Part II. For Days under 10 in a Medium, to add at above 90 Days.

Principal.	350 Days.				360 Days.				365 Days.				1 Day.			2 Days.			3 Days.		
	l.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.
1			11	0			11	1			11	1									
2		1	10	0		1	10	2		1	11	0									1
3		2	9	0		2	9	3		2	10	1					1				1
4		3	8	0		3	9	1		3	9	2					1				1
5		4	7	0		4	8	2		4	9	0					1				2
6		5	6	0		5	7	3		5	8	2		1			1				2
7		6	5	0		6	7	0		6	8	0		1			2				3
8		7	4	0		7	6	1		7	7	2		1			2				3
9		8	3	0		8	5	2		8	6	3		1			2				3
10		9	2	0		9	4	3		9	6	1		1			2		1	0	
20		18	3	3		18	9	2		19	0	2		2		1	1		2	0	
30	1	7	5	2	1	8	2	2	1	8	6	3		1	0		1	3		2	3
40	1	16	7	1	1	17	7	1	1	18	1	1		1	1		2	1		3	3
50	2	5	9	0	2	7	0	0	2	7	7	2		1	2		3	1		4	3
60	2	14	10	3	2	16	4	3	2	17	1	3		1	3		3	3		5	2
70	3	4	0	2	3	5	9	2	3	6	8	0		2	1		4	2		6	2
80	3	13	2	2	3	15	2	2	3	16	2	1		2	2		5	0		7	2
90	4	2	4	1	4	4	7	1	4	5	8	2		3	0		5	3		8	2
100	4	11	6	0	4	14	0	0	4	15	2	3		3	1		6	1		9	1
200	9	3	0	0	9	7	11	3	9	10	5	3		6	1	1	0	2	1	6	3
300	13	14	6	0	14	1	11	3	14	5	8	2		9	2	1	6	3	2	4	1
400	18	6	0	0	18	15	11	3	19	0	11	2	1	0	2	2	1	0	3	1	2
500	22	17	6	1	23	9	11	3	23	16	2	1	1	3	3	2	7	1	3	11	0
600	27	9	0	1	28	3	11	2	28	11	5	1	1	6	3	3	1	2	4	8	1
700	32	0	6	1	32	17	11	2	33	6	8	0	1	10	0	3	7	3	5	5	3
800	36	12	0	1	37	11	11	2	38	1	11	0	2	1	0	4	2	0	6	3	1
900	41	3	6	1	42	5	11	2	42	17	1	3	2	4	1	4	8	1	7	0	2
1000	45	15	0	1	46	19	11	1	47	12	4	3	2	7	1	5	2	2	7	9	3
ditto	l. 45.75	16			l. 46.99	73			l. 47.61	19			l. 0.13	04		l. 0.26	08		l. 0.39	12	

Part II. For Days under 10 in a Medium, to add at
above 90 Days.

Principal. l.	4 Days.			5 Days.			6 Days.			7 Days.			8 Days.				9 Days.			
	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.	l.	s.	d.	q.	l.	s.	d.	q.
1						0			1			1			1					1
2			1			1			1			2			2					2
3			1			2			2			3			3					3
4			2			2			3			3			1 0				1 0	
5			2			3			1 0			1 0			1 1				1 2	
6			3			1 0			1 0			1 1			1 2				1 3	
7			3			1 0			1 1			1 2			1 3				2 0	
8			1 0			1 1			1 2			1 3			2 0				2 1	
9			1 0			1 2			1 3			2 0			2 1				2 2	
10			1 1			1 2			2 0			2 1			2 2				3 0	
20			2 2			3 1			3 3			4 2			5 0				5 3	
30			3 3			4 3			5 3			6 2			7 2				8 2	
40			5 0			6 1			7 2			8 3			10 0				11 1	
50			6 1			7 3			9 2			11 0			1 0 2			1 2 0		
60			7 2			9 2			11 1		1 1 1	1 1 1			1 3 0			1 5 0		
70			8 3			11 0		1 1 1	1 1 1		1 3 1	1 3 1			1 5 2			1 7 3		
80			10 0			1 0 2		1 3 0	1 3 0		1 5 2	1 5 2			1 8 0			1 10 2		
90			11 1			1 2 0		1 5 0	1 5 0		1 7 3	1 7 3			1 10 2			2 1 1		
100	1		0 2			1 3 3		1 6 3	1 6 3		1 10 0	1 10 0			2 1 0			2 4 1		
200	2		1 0			2 7 1		3 1 2	3 1 2		3 7 3	3 7 3			4 2 0			4 8 1		
300	3		1 2			3 11 0		4 8 1	5 5 3		5 5 3	5 5 3			6 3 0			7 0 2		
400	4		2 0			5 2 2		6 3 1	7 3 3		7 3 3	7 3 3			8 4 0			9 4 3		
500	5		2 2			6 6 1		7 10 0	9 1 2		9 1 2	9 1 2			10 5 1			11 8 3		
600	6		3 1			7 10 0		9 4 3	10 11 2		10 11 2	10 11 2			12 6 1			14 1 0		
700	7		3 3			9 1 2		10 11 2	12 9 1		12 9 1	12 9 1			14 7 1			16 5 1		
800	8		4 1			10 5 1		12 6 1	14 7 1		14 7 1	14 7 1			16 8 1			18 9 1		
900	9		4 3			11 8 3		14 1 0	16 5 1		16 5 1	16 5 1			18 9 1			1 1 1 2		
1000	10		5 1			13 0 2		15 7 3	18 3 0		18 3 0	18 3 0			1 0 10 1			1 3 5 3		
ditto	l. 0.5216			l. 0.652			l. 0.7824			l. 0.9128			l. 1.0432				l. 1.1736			

The Use of the Tables of Discount foregoing.

Q. 1. What is the Discount of £. 700 (if paid 137 days before due) at 4 per Cent?

In the 1st Table against £. 700, under 130 days is £. 9 : 16 : 7 $\frac{1}{4}$
 700 under 7 days (part the 2d, } — : 10 : 3
 at the end of the Table) — }

Sum, or Answer — = £. 10 : 6 : 10 $\frac{3}{4}$

Q. 2. What is the Discount of £. 1500 for 57 Days at 5 per Cent?

By the Method in the Margin, the Answer is found
 £. 11 : 11 : 5 $\frac{1}{2}$.

£.	Days.	
1000	for 50	= £. 6 : 16 : 0 $\frac{1}{4}$
500		3 : 8 : 0 $\frac{1}{4}$
1000	for 7	= 0 : 19 : 0
500		0 : 9 : 1 $\frac{1}{2}$
		<hr/>
		£. 11 : 12 : 4 $\frac{1}{2}$ = Sum

I shall give another Example, which takes in all the Varietys of the Use of the Table.

Example 2.] What Discount at 5 per Cent. is to be allow'd, to satisfy a Debt of £. 5000, 91 Days before the same is due?

Note, That for 1, 2, 3, 4, 5, 6, 7, 8, and 9 Days, from and above 90, &c. to 360; I take those Tabular Numbers against 1, 2, &c. to 9, at the end of the Table of Discount.

£.	Days.	
Against 1000 (or ditto) under 90	stands	12.1786
And under 1 (part 2.)	=	0.1304
		} add.

Sum = 12.3090.

Which multiply by the Thousands — = 5

The Answer or Product = 61.545 = £. 61 : 10 : 11;

But had this Question been done by the Tables in Dr. Harris's *Lexicon*, which he says are accurate; it will be found £. 2 : 5 : 0 $\frac{1}{2}$ too little. For 91 Days multiplied in £. 5000 gives 455000. And by those Tables you have against 400000 = 52.1853

50000 = 6.5232

5000 = 0.6523

Sum = 59.3608 = £. 59 : 7 : 2 $\frac{1}{2}$

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Which taken from my Discount above, is too little by $l. 2 : 3 : 8\frac{1}{2}$ as I have fully proved before the Tables above.

III. Of Compound Interest : The Use of Decimals.

I have shew'd above, what Compound Interest is, and now proceed to give the Reader the Use of Decimals in computing thereof.

Case 1. To find the Amount of any Sum of Money for any Number of Years, as of $l. 650$ for 5 Years at 5 *per Cent. per Ann.* Compound Interest.

Rule. First find the Amount of $l. 1$ for 5 Years, and multiply the 5th Year by $l. 650$, the Principal given, thus :

Example. 1st, $100. 105 :: 1. 1.05 =$ at the end of 1 Year.

2dly, $100. 105 :: 1.05$

105

3dly, $100. 105 :: 1.1025 =$ of the 2d Year.

105

4thly, $100. 105 :: 1.157625 =$ of the 3d Year.

105

5thly, $100. 105 :: 1.21550625 =$ the 4th Year.

105

Answer = $1.2762815625 =$ 5th Year.

650 multiply.

The Amount of $l. 650$ } = $829.5830156 =$ Answer.
for 5 Years ———

Or it will be the same thing to multiply the 3d Number by 1.05 continually; *i. e.* to multiply the Sur-solid of 1.05 by 650.

In this Example you see that every Year requires a Multiplication performed as *per Compend. 2.* of Multiplication of Decimals, and the last by the 650, as *per Compend. 6.* whereby 'tis found, that if $l. 650$ be put out and forborn 5 Years, the Interest of that Principal, and of the Interest accruing, will amount to $l. 829 : 11 : 8$.

Case 2. To find the present Worth of any Sum due any Number of Years hence, as of $l. 829 : 11 : 8$ (or $l. 829.583015625$) due at the end of 5 Years. See the Operation at 5 *per Cent.* Compound Interest, or divide the Number given, &c. by 1.05. continually.

1.05.

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$$1.05. 100 :: 829.5, &c.$$

$$1.05) 82958.3015625 (790.076200595 = 1 \text{ Year hence.}$$

945

800

651

210

625

1000

550

$$105) 79007.620059500 (752.453524376 \text{ ---}$$

Worth 2 Year hence. | 25

550

257

476

562

370

550

255

459

395

800

650

$$3dly, 105. 100 :: 752.453524376. 716.622423 = 3 \text{ Years hence.}$$

$$4thly, 105. 100 :: 716.622423. 682.497164 = \text{present Worth 4 (Years hence.}$$

$$5thly, 105. 100 :: 682.497164. 650. = \text{the present Worth of the Sum given, viz. l. 829 : 11 : 8 due at the end of 5 Years.}$$

Here you may observe, that the 4th Proportional is always the 3d Number in the Proportion the next stating : And having for every Year multiplied by 100, and divided by 105, and the proposed Rate of Interest, (directly contrary to what you did in the last Case) the 4th Proportional in the 5th Operation is l. 650, which is the

the present Worth of $1.829 : 11 : 8$, due at the end of 5 Years ; which proves the Truth of the last Case : $001.70.1$

And after the same manner, had you desired to have found the present Worth of 1.1 due 5 Years hence, the several Years Decrease would be as in the following Table, Column 2. from that of Years.

Years.	The Amount of $1.1.$	The present Worth of $1.1.170$	The Amount of $1.1. Annuity.$	The present Worth of $1.1. Annuity.$
1	1.05	.95238095	1	.95238095
2	1.1025	.90702947	2.05	1.85941042
3	1.157625	.86383759	3.1525	2.72324801
4	1.21550625	.82270247	4.310125	3.54595048
5	1.27628156	.78352616	5.52563125	4.32947664

Case 3. To find the Amount of Annuitys forborn any Number of Years, you will easily consider, that at the end of 1 Year there is 1 Year's Income due without any Interest ; for the 2d Year, at the end of that, there is 2 Years Income due, and the Interest of 1 Year ; at the end of the 3d Year, there is due 3 Years Income ; 2 Years Interest of the 1st Year's Income, 1 Year's Interest of the 2d Year's Income, and 1 Year's Interest of the Interest of the 1st Year's Income, &c.

Thus suppose the Rent 1 l per ann. the 3 Years Income is 1.3
 2 Years Interest of the 1st Year's Income $= 0.1$
 1 Years Interest of the 2d Year's Income $= 0.05$
 And 1 Year's Interest of the Interest of the 1st Year's Income $= 0.0025$

The Sum is the utmost Improvement of this } $= 3.1525$
 Annuity for 3 Years, viz. _____

Hence it follows, that a Table of the Amount of 1 l. Annuity , as the 3d Column above is made from the Column of the Amount of $1.1.$ by making the Tabular Number for the 1st Year 1 ; for the 2d in the 3d Column the Sum of the 2 first Numbers in the 1st and 3d Columns ; the 3d Number in the 3d Column is the Sum of the 3d Number in the 1st and 3d Columns, &c.

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Case 4. To find the present Worth of an Annuity due any Number of Years to come, it must be considered that the present Worth of 1 *l.* Annuity to continue 1 Year is the same with the present Worth of 1 *l.* due a Year hence. So that the present Worth of an Annuity to continue 2 Years, is the Sum of the present Worth thereof for 1 Year, and the present Worth of the like Sum with the Annuity to continue 2 Years; and thus the 4th Column in the above Tablet is made: For

N^o Col.

The 1 in the 4 is .95238095 } Sum = the 2d in Col. 4.

2 ——— 2 — .90702947 } viz. 1.85941042.

2 ——— 4 — 1.85941042 } Sum = the 3d in Col. 4.

3 ——— 2 — .86383759 } viz. 2.72324801, &c.

Case 5. To find what Annuity, to continue any Number of Years, any Sum will purchase. Divide a Unit by any of the Numbers which are the present Worth of 1 *l.* Annuity for any Years, and the Quotient shews the Annuity that 1 *l.* will purchase to continue those Years. Thus if I would know what 1 *l.* will purchase *per ann.* to continue 5 Years:

As 4.32947664. 1 :: 1. .23097480 = Answ. = 4 s. 7 d. $\frac{1}{2}$
(per ann.)

Farther Rules concerning the five Cases above.

1. To enlarge the Numbers tabulated above, and what is under the 5th Case, to any Number of Years, two ways.

2. How to use them for any other Sum, above 1 *l.*

1. You may augment the first and second Columns by several Operations, as taught above, from 5 Years to 50, &c. and from them may make the third and fourth Columns, and another shewing what 1 *l.* will purchase to continue those Years.

Or, because the Numbers in the 1st Column of Compound Interest are in proportion as 100 to 105, or as 1 to 1.05, therefore that Column is a Series in Geometrical Proportion, whose Ratio is 1.05, so that (as in *Progression*, Sect. 2. Chap. 2.) if you have no occasion for the intermediate Numbers, but would know the Amount, present Worth of any Sum or Annuity, &c. for 41 Years; for the Amount of 1 *l.* multiply the 1.27628156 by itself, and it produceth the Amount for 10 Years; which if you multiply by itself, produceth the Amount for 20 Years; and that multiplied by itself, produceth the Amount for 40 Years. And having done the like

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With the the 2d Column (of the present Worth of *l. 1*) and found the present Worth for 40 Years; you may easily by the Rules under the first and second Case find the Amount or present Worth for one Year more. And having those two for 40 and 41 Years, you may easily from thence calculate the Amount, present Worth, or Purchase of Annuitys, as is shew'd under the 3d, 4th and 5th Cases.

2. For Sums of Money or Annuitys above *l. 1*, you have nothing to do but to multiply respectively by such Pounds: Thus for *l. 500* 5 Years,

l.

If you multiply 1.27628156 by 500 you have the Amount of
(*l. 500*, 5 Years.

.78352616 by 500, you have the present
(Worth of *l. 500* due 5 Years hence.

5.52563125 by 500, you have the Amount of
(*l. 500 per ann.* for 5 Years.

4.32947664 by 500, you have the present
(Worth of *l. 500 per ann.*
to continue 5 Years.

And as in Case 5. .2309748 by 500, you have the Annuity that
(*l. 500* will purchase to
continue 5 Years.

And the like for any other Sums or Terms of Years.

But all these things (if you are without Tables of Interest) are most easily and concisely done by the Logarithms, as appears in that Part of Arithmetic hereafter following.

Compound

COMPOUND INTEREST *at 3 per Cent.*

<i>Years.</i>	TABLE I. <i>The Amount of l. l.</i>	TABLE II. <i>The present Worth of l. l.</i>	TABLE III. <i>The Amount of l. l. Annuity.</i>	TABLE IV. <i>The present Worth of l. l. Annuity.</i>
1	1.03	.9708738	1	.9708738
2	1.0609	.9425959	2.03	1.9134697
3	1.092727	.9151417	3.0909	2.8286114
4	1.1255088	.8884870	4.183627	3.7170984
5	1.1592741	.8626088	5.3091358	4.5797072
6	1.1940523	.8374843	6.4684099	5.4171914
7	1.2298739	.8130915	7.6624622	6.2302829
8	1.2667701	.7894092	8.8923360	7.0196922
9	1.3047732	.7664167	10.1591061	7.7861089
10	1.3439164	.7440939	11.4638793	8.5302028
11	1.3842339	.7224213	12.8077957	9.2526241
12	1.4257609	.7013799	14.1920296	9.9540040
13	1.4685337	.6809513	15.6177904	10.6349553
14	1.5125897	.6611178	17.0863242	11.2960731
15	1.5579674	.6418619	18.5989139	11.9379351
16	1.6047064	.6231669	20.1568813	12.5611020
17	1.6528476	.6050164	21.7615877	13.1661185
18	1.7024331	.5873946	23.4144354	13.7535131
19	1.7535061	.5702860	25.1168684	14.3237991
20	1.8061112	.5536758	26.8703745	14.8774748
21	1.8602946	.5375493	28.6764857	15.4150241
22	1.9161034	.5218925	30.5367803	15.9369166
23	1.9735865	.5066917	32.4528837	16.4436084
24	2.0327941	.4919337	34.4264702	16.9355421
25	2.0937779	.4776056	36.4592643	17.4131477
26	2.1565913	.4636947	38.5530422	17.8768420
27	2.2212890	.4501891	40.7096335	18.3270315
28	2.2879277	.4370768	42.9309225	18.7641082
29	2.3565655	.4243464	45.2188502	19.1884546
30	2.4272625	.4119868	47.5754157	19.6004413
31	2.5000803	.3999871	50.0026782	20.0004285

COMPOUND INTEREST *at 3 per Cent.*

<i>Years.</i>	TABLE I. Continu'd. <i>The Amount of l. l.</i>	TABLE II. Continu'd. <i>The present Worth of l. l.</i>	TABLE III. Continu'd. <i>The Amount of l. l. Annuity.</i>	TABLE IV. Continu'd. <i>The present Worth of l. l. Annuity.</i>
32	2.5750828	.3883370	52.5027585	20.3887655
33	2.6523352	.3770262	55.0778413	20.7657918
34	2.7319053	.3660449	57.7301765	21.1318367
35	2.8138624	.3553834	60.4620818	21.4872200
36	2.8982783	.3450324	63.2759443	21.8322525
37	2.9852267	.3349829	66.1742226	22.1672354
38	3.0747835	.3252262	69.1594493	22.4924616
39	3.1670270	.3157535	72.2342327	22.8082151
40	3.2620378	.3065568	75.4012597	23.1147719
41	3.3598989	.2976280	78.6632975	23.4123999
42	3.4606959	.2889592	82.0231964	23.7013592
43	3.5645168	.2805429	85.4838923	23.9819021
44	3.6714523	.2723718	89.0484091	24.2542739
45	3.7815959	.2644386	92.7198614	24.5187125
46	3.8950437	.2567365	96.5014572	24.7754490
47	4.0118950	.2492588	100.3965009	25.0247078
48	4.1322519	.2419988	104.4083960	25.2667066
49	4.2562194	.2349503	108.5406479	25.5016569
50	4.3839060	.2281071	112.7968673	25.7297640
51	4.5154232	.2214632	117.1807733	25.9512271
52	4.6508859	.2150128	121.6961966	26.1662399
53	4.7904125	.2087503	126.3470825	26.3749902
54	4.9341249	.2026702	131.1374949	26.5776040
55	5.0821486	.1967672	136.0716198	26.7744276
56	5.2346131	.1910361	141.1537684	26.9654637
57	5.3916515	.1854719	146.3883815	27.1509356
58	5.5534010	.1800698	151.7800329	27.3310054
59	5.7200030	.1748251	157.3334339	27.5058305
60	5.8916031	.1697331	163.0534369	27.6755636
61	6.0683512	.1647894	168.9450400	27.8403530

COMPOUND INTEREST at 4 per Cent.

Years.	TABLE V.	TABLE VI.	TABLE VII.	TABLE VIII.
	<i>The Amount of 1. l.</i>	<i>The present Worth of 1. l.</i>	<i>The Amount of 1. l. Annuity.</i>	<i>The present Worth of 1. l. Annuity.</i>
1	1.04	.9615385	1.0	.9615385
2	1.0816	.9245562	2.04	1.8860947
3	1.124864	.8889964	3.1216	2.7750910
4	1.1698586	.8548042	4.246464	3.6298952
5	1.2166529	.8219271	5.4163226	4.4518223
6	1.2653190	.7903145	6.6329755	5.2421369
7	1.3159318	.7599178	7.8982945	6.0020547
8	1.3685691	.7306901	9.2142263	6.7327448
9	1.4233118	.7025866	10.5827953	7.4353314
10	1.4802443	.6755641	12.0061071	8.1108955
11	1.5394541	.6495808	13.4863514	8.7604763
12	1.6010322	.6245970	15.0258055	9.3850733
13	1.6650735	.6005740	16.6268377	9.9856473
14	1.7316764	.5774750	18.2919112	10.5631223
15	1.8009435	.5552644	20.0235876	11.1183868
16	1.8729812	.5339081	21.8245311	11.6522949
17	1.9479005	.5133732	23.6975124	12.1656680
18	2.0258165	.4936281	25.6454129	12.6592961
19	2.1068492	.4746424	27.6712294	13.1339385
20	2.1911231	.4563869	29.7780786	13.5903253
21	2.2787681	.4388335	31.9692017	14.0291589
22	2.3699188	.4219553	34.2479698	14.4511142
23	2.4647155	.4057263	36.6178886	14.8568405
24	2.5633042	.3901214	39.0826041	15.2469619
25	2.6658363	.3751168	41.6459083	15.6220787
26	2.7724698	.3606892	44.3117446	15.9827678
27	2.8833686	.3468165	47.0842144	16.3295844
28	2.9987033	.3334774	49.9675830	16.6630618
29	3.1186515	.3206514	52.9662863	16.9837132
30	3.2433975	.3083186	56.0849377	17.2920318
31	3.3731334	.2964602	59.3283352	17.5884921

COMPOUND INTEREST *at 4 per Cent.*

<i>Years.</i>	TABLE V. Continu'd.	TABLE VI. Continu'd.	TABLE VII. Continu'd.	TABLE VIII. Continu'd.
	<i>The Amount of l. i.</i>	<i>The present Worth of l. i.</i>	<i>The Amount of l. i. Annuity.</i>	<i>The present Worth of l. i. Annuity.</i>
32	3.5080587	.2850579	62.7014687	17.8735500
33	3.6483811	.2740941	66.2095274	18.1476441
34	3.7943163	.2635521	69.8579045	18.4111962
35	3.9460890	.2534154	73.6522248	18.6646116
36	4.1039326	.2436687	77.5983138	18.9082803
37	4.2680899	.2342968	81.7022464	19.1425771
38	4.4388134	.2252854	85.9703362	19.3678625
39	4.6163660	.2166206	90.4091497	19.5844831
40	4.8010206	.2082890	95.0255157	19.7927721
41	4.9930615	.2002779	99.8265363	19.9930500
42	5.1927839	.1925749	104.8195978	20.1856250
43	5.4004953	.1851682	110.0123817	20.3707931
44	5.6165151	.1780463	115.4128769	20.5488395
45	5.8411757	.1711984	121.0293920	20.7200378
46	6.0748227	.1646138	126.8705677	20.8846517
47	6.3178156	.1582825	132.9453904	21.0429342
48	6.5705282	.1521947	139.2632060	21.1951289
49	6.8333494	.1463411	145.8337342	21.3414700
50	7.1066833	.1407126	152.6670836	21.4821826
51	7.3909507	.1353006	159.7737670	21.6174832
52	7.6865887	.1300967	167.1647176	21.7475800
53	7.9940522	.1250930	174.8513063	21.8726729
54	8.3138143	.1202817	182.8453586	21.9929546
55	8.6463669	.1156555	191.1591729	22.1086100
56	8.9922216	.1112072	199.8055398	22.2198172
57	9.3519105	.1069300	208.7977614	22.3267472
58	9.7259869	.1028173	218.1496719	22.4295645
59	10.1150263	.0988628	227.8756588	22.5284273
60	10.5196274	.0950604	237.9906851	22.6234877
61	10.9404125	.0914042	248.5103125	22.7148919

COMPOUND INTEREST at 5 per Cent.

Years.	TABLE IX.	TABLE X.	TABLE XI.	TABLE XII.
	<i>The Amount of l. l.</i>	<i>The present Worth of l. l.</i>	<i>The Amount of l. l. Annuity.</i>	<i>The present Worth of l. l. Annuity.</i>
1	1.05	.9523809	1.0	.9523809
2	1.1025	.9070294	2.05	1.8594103
3	1.157625	.8638376	3.1525	2.7232480
4	1.2155063	.8227025	4.310125	3.5459505
5	1.2762816	.7835262	5.5256312	4.3294767
6	1.3400956	.7462154	6.8019128	5.0756921
7	1.4071064	.7106813	8.1420084	5.7863734
8	1.4774554	.6768394	9.5491089	6.4632128
9	1.5513282	.6446089	11.0265643	7.1078217
10	1.6288946	.6139133	12.5778925	7.7217349
11	1.7103393	.5846929	14.2067871	8.3064142
12	1.7958563	.5568374	15.9171265	8.8632516
13	1.8856491	.5303213	17.7129828	9.3935730
14	1.9799316	.5050680	19.5986320	9.8986409
15	2.0789282	.4810171	21.5785636	10.3796580
16	2.1828746	.4581115	23.6574918	10.8377695
17	2.2920183	.4362967	25.8403664	11.2740662
18	2.4066192	.4155207	28.1323847	11.6895869
19	2.5269502	.3957340	30.5390039	12.0853208
20	2.6532977	.3768895	33.0659541	12.4622103
21	2.7859626	.3589424	35.7192518	12.8211527
22	2.9252607	.3418499	38.5052144	13.1630026
23	3.0715238	.3255713	41.4304751	13.4885739
24	3.2251000	.3100679	44.5019989	13.7986418
25	3.3863549	.2953028	47.7270988	14.0939445
26	3.5556727	.2812407	51.1134537	14.3751853
27	3.7334563	.2678483	54.6691264	14.6430336
28	3.9201291	.2550936	58.4025827	14.8981272
29	4.1161356	.2429463	62.3227119	15.1410735
30	4.3219424	.2313774	66.4388474	15.3724510
31	4.5380395	.2203595	70.7607898	15.5928104

COMPOUND INTEREST at 5 per Cent.

Years.	TABLE IX. Continu'd.	TABLE X. Continu'd.	TABLE XI. Continu'd.	TABLE XII. Continu'd.
	<i>The Amount of l. l.</i>	<i>The present Worth of l. l.</i>	<i>The Amount of l. l. Annuity.</i>	<i>The present Worth of l. l. Annuity.</i>
32	4.7649415	.2098662	75.2988293	15.8026766
33	5.0031885	.1998725	80.0637708	16.0025491
34	5.2533480	.1903548	85.0669593	16.1929039
35	5.5160154	.1812903	90.3203073	16.3741942
36	5.7918161	.1726574	95.8363226	16.5468516
37	6.0814069	.1644356	101.6281387	16.7112872
38	6.3854773	.1566054	107.7095457	16.8678926
39	6.7047511	.1491480	114.0950229	17.0170406
40	7.0399887	.1420457	120.7997741	17.1590862
41	7.3919881	.1352816	127.8397628	17.2943678
42	7.7615875	.1288396	135.2317509	17.4232074
43	8.1496669	.1227044	142.9933385	17.5459118
44	8.5571503	.1168613	151.1430054	17.6627732
45	8.9850078	.1112965	159.7001556	17.7740697
46	9.4342582	.1059967	168.6851634	17.8800663
47	9.9059711	.1009492	178.1194216	17.9810155
48	10.4012696	.0961421	188.0253927	18.0771576
49	10.9213331	.0915639	198.4266623	18.1687215
50	11.4674000	.0872037	209.3479954	18.2559253
51	12.0407698	.0830512	220.8153952	18.3389764
52	12.6428082	.0790963	232.8561649	18.4180728
53	13.2749486	.0753298	245.4989731	18.4934026
54	13.9386961	.0717427	258.7739218	18.5651453
55	14.6356309	.0683264	272.7126179	18.6334720
56	15.3674124	.0650727	287.3482488	18.6985444
57	16.1357831	.0619740	302.7156612	18.7605185
58	16.9425722	.0590229	318.8514442	18.8195414
59	17.7897008	.0562123	335.7940164	18.8757536
60	18.6791858	.0535355	353.5837172	18.9292882
61	19.6131451	.0509862	372.2629031	18.9802743

COMPOUND INTEREST at 6 per Cent.

<i>Years.</i>	TAB. XIII. <i>The Amount of 1.1.</i>	TAB. XIV. <i>The present Worth of 1.1.</i>	TABLE XV. <i>The Amount of 1.1 Annuity.</i>	TABLE XVI. <i>The present Worth of 1.1 Annuity.</i>
1	1.06	.9433962	1.0	.9433962
2	1.1236	.8899964	2.06	1.8333926
3	1.191016	.8396193	3.1836	2.6730119
4	1.2624769	.7920937	4.3746016	3.4651056
5	1.3382256	.7472582	5.6370930	4.2123638
6	1.4185191	.7049605	6.9753187	4.9173244
7	1.5036303	.6650571	8.3938378	5.5823815
8	1.5938481	.6274124	9.8974681	6.2097939
9	1.6894790	.5918985	11.4913162	6.8016923
10	1.7908477	.5583948	13.1807958	7.3600871
11	1.8982980	.5267875	14.9716435	7.8868747
12	2.0121965	.4969694	16.8699420	8.3838440
13	2.1329283	.4688390	18.8821385	8.8526831
14	2.2609039	.4423010	21.0150667	9.2949840
15	2.3965582	.4172651	23.2759707	9.7122491
16	2.5402517	.3936463	25.6725289	10.1058953
17	2.6927728	.3713644	28.2128806	10.4772597
18	2.8543392	.3503438	30.9056534	10.8276035
19	3.0255995	.3305130	33.7599925	11.1581165
20	3.2071355	.3118047	36.7855920	11.4699213
21	3.3995636	.2941554	39.9927275	11.7640767
22	3.6035374	.2775051	43.3922911	12.0415818
23	3.8197497	.2617973	46.9958285	12.3033790
24	4.0489346	.2469786	50.8155782	12.5503576
25	4.2918707	.2329986	54.8645128	12.7833562
26	4.5493829	.2198100	59.1563835	13.0031663
27	4.8223459	.2073680	63.7057664	13.2105342
28	5.1116866	.1956301	68.5281123	13.4061644
29	5.4183878	.1845567	73.6397990	13.5907211
30	5.7434911	.1741101	79.0581868	13.7648312
31	6.0881006	.1642548	84.8016779	13.9290861

COMPOUND INTEREST *at 6 per Cent.*

Years.	TAB. XIII. Continu'd. <i>The Amount of l. l.</i>	TAB. XIV. Continu'd. <i>The present Worth of l. l.</i>	TABLE XV. Continu'd. <i>The Amount of l. l. Annuity.</i>	TABLE XVI. Continu'd. <i>The present Worth of l. l. Annuity.</i>
32	6.4533866	.1549574	90.8897785	14.0840435
33	6.8405898	.1461862	97.3431652	14.2302297
34	7.2510252	.1379115	104.1837550	14.3681412
35	7.6860867	.1301052	111.4347802	14.4982465
36	8.1472519	.1227407	119.1208669	14.6209872
37	8.6360870	.1157932	127.2681188	14.7367804
38	9.1542523	.1092388	135.9042059	14.8460192
39	9.7035074	.1030555	145.0584581	14.9490747
40	10.2857178	.0972222	154.7619655	15.0462969
41	10.9028609	.0917190	165.0476833	15.1380160
42	11.5570326	.0865274	175.9505442	15.2245434
43	12.2504545	.0816296	187.5075769	15.3061730
44	12.9854818	.0770091	199.7580314	15.3831821
45	13.7646107	.0726500	212.7435132	15.4558321
46	14.5904873	.0685378	226.5081239	15.5243699
47	15.4659166	.0646583	241.0986112	15.5890282
48	16.3938716	.0609984	256.5645278	15.6500266
49	17.3775039	.0575457	272.9583994	15.7075723
50	18.4201541	.0542884	290.3359032	15.7618610
51	19.5253634	.0512154	308.7560573	15.8130761
52	20.6968852	.0483164	328.2814207	15.8613925
53	21.9386983	.0455816	348.9783059	15.9069741
54	23.2550202	.0430015	370.9170041	15.9499760
55	24.6503214	.0405674	394.1720243	15.9905430
56	26.1293406	.0382712	418.8223456	16.0288141
57	27.6971011	.0361049	444.9516863	16.0649190
58	29.3589272	.0340612	472.6487874	16.0989802
59	31.1204628	.0321332	502.0077145	16.1311134
60	32.9876905	.0303143	533.1281773	16.1614277
61	34.9669520	.0285984	566.1158679	16.1900261

COMPOUND INTEREST at 8 per Cent.

<i>Years.</i>	TABLE XVII.	TAB. XVIII.	TABLE XIX.	TABLE XX.
	<i>The Amount of l. 1.</i>	<i>The present Worth of l. 1.</i>	<i>The Amount of l. 1 Annuity.</i>	<i>The present Worth of l. 1 Annuity.</i>
1	1.08	.9259259	1.0	.9259259
2	1.1664	.8573388	2.08	1.7832648
3	1.259712	.7938224	3.2464	2.5770979
4	1.3604890	.7350299	4.506112	3.3121268
5	1.4693281	.6805832	5.866010	3.9927100
6	1.5868743	.6301696	7.3359290	4.6228797
7	1.7138243	.5834904	8.9228034	5.2063701
8	1.8509302	.5402689	10.6366276	5.7466389
9	1.9990046	.5002490	12.4875579	6.2468879
10	2.1589250	.4631935	14.4865626	6.7100814
11	2.3316390	.4288829	16.6454876	7.1389643
12	2.5181701	.3971138	18.9771266	7.5360780
13	2.7196237	.3676979	21.4952967	7.9037759
14	2.9371936	.3404610	24.2149204	8.2442370
15	3.1721691	.3152417	27.1521140	8.5594790
16	3.4259426	.2918905	30.3242831	8.8513691
17	3.7000181	.2702689	33.7502258	9.1216381
18	3.9960195	.2502490	37.4502438	9.3718871
19	4.3157011	.2317121	41.4462633	9.6035992
20	4.6609571	.2145482	45.7619644	9.8181474
21	5.0338337	.1986557	50.4229215	10.0168031
22	5.4365404	.1839405	55.4567552	10.2007436
23	5.8714636	.1703153	60.8932956	10.3710589
24	6.3411827	.1576993	66.7647593	10.5287582
25	6.8484752	.1460179	73.1059400	10.6747761
26	7.3963532	.1352018	79.9544152	10.8099779
27	7.9880615	.1251868	87.3507684	10.9351647
28	8.6271064	.1159137	95.3388299	11.0510784
29	9.3172749	.1073275	103.9659363	11.1584059
30	10.0626569	.0993773	113.2832112	11.2577833
31	10.8676694	.0920160	123.3458680	11.3497993

COMPOUND INTEREST *at 8 per Cent.*

<i>Years.</i>	TABLE XVII. Continu'd. <i>The Amount of l. l.</i>	TAB. XVIII Continu'd. <i>The present Worth of l. l.</i>	TABLE XIX. Continu'd. <i>The Amount of l. l. Annuity.</i>	TABLE XX. Continu'd. <i>The present Worth of l. l. Annuity.</i>
32	11.7370830	.0852000	134.2135375	11.4349993
33	12.6760496	.0788889	145.9506205	11.5138883
34	13.6901336	.0730453	158.6266701	11.5869336
35	14.7853443	.0676345	172.3168037	11.6545681
36	15.9681718	.0626246	187.1021480	11.7171927
37	17.2456255	.0579857	203.0703198	11.7751784
38	18.6252756	.0536905	220.3159454	11.8288689
39	20.1152976	.0497134	238.9412209	11.8785823
40	21.7245214	.0460309	259.0565186	11.9246132
41	23.4624832	.0426212	280.7810400	11.9672344
42	25.3394818	.0394641	304.2435232	12.0066985
43	27.3666404	.0365408	329.5830050	12.0432394
44	29.5559716	.0338341	356.9496454	12.0770735
45	31.9204493	.0313279	386.5056169	12.1084014
46	34.4740853	.0290073	418.4260663	12.1374087
47	37.2320121	.0268586	452.9001515	12.1642673
48	40.2105730	.0248691	490.1321636	12.1891363
49	43.4274189	.0230269	530.3427367	12.2121633
50	46.9016124	.0213212	573.7701556	12.2334845
51	50.6537414	.0197419	620.6717680	12.2532264
52	54.7060407	.0182795	671.3255094	12.2715059
53	59.0825240	.0169255	726.0315501	12.2884314
54	63.8091259	.0156717	785.1140741	12.3041031
55	68.9138560	.0145109	848.9232000	12.3186140
56	74.4269644	.0134360	917.8370559	12.3320500
57	80.3811216	.0124408	992.2640203	12.3444908
58	86.8116113	.0115192	1072.6451419	12.3560100
59	93.7565402	.0106660	1159.4567532	12.3666760
60	101.2570634	.0098759	1253.2132934	12.3765518
61	109.3576285	.0091443	1354.4703569	12.3856962

COMPOUND INTEREST at 10 per Cent.

Years.	TABLE XXI.	TAB. XXII.	TAB. XXIII.	TAB. XXIV.
	<i>The Amount of 1. 1.</i>	<i>The present Worth of 1. 1.</i>	<i>The Amount of 1. 1 Annuity.</i>	<i>The present Worth of 1. 1 Annuity.</i>
1	1.1	.9090909	1.	.9090909
2	1.21	.8264463	2.1	1.7355372
3	1.331	.7513148	3.31	2.4868520
4	1.4641	.6830135	4.641	3.1698654
5	1.61051	.6209213	6.1051	3.7907868
6	1.771561	.5644739	7.71561	4.3552607
7	1.9487171	.5131581	9.487171	4.8684188
8	2.1435888	.4665074	11.4358881	5.3349262
9	2.3579477	.4240976	13.5794769	5.7590238
10	2.5937425	.3855433	15.9374246	6.1445671
11	2.8531167	.3504939	18.5311671	6.4950610
12	3.1384284	.3186308	21.3842838	6.8136918
13	3.4522712	.2896644	24.5227121	7.1033562
14	3.7974983	.2633313	27.9749834	7.3666875
15	4.1772482	.2393920	31.7724817	7.6060795
16	4.5949730	.2176291	35.9497299	7.8237086
17	5.0544703	.1978446	40.5447028	8.0215533
18	5.5599173	.1798588	45.5991731	8.2014121
19	6.1159090	.1635080	51.1590904	8.3649201
20	6.7274999	.1486436	57.2749995	8.5135637
21	7.4002499	.1351306	64.0024994	8.6486943
22	8.1402749	.1228460	71.4027494	8.7715403
23	8.9543024	.1116782	79.5430243	8.8832184
24	9.8497327	.1015256	88.4973268	8.9847440
25	10.8347059	.0922960	98.3470594	9.0770400
26	11.9181765	.0839055	109.1817654	9.1609455
27	13.1099942	.0762777	121.0999419	9.2372232
28	14.4209936	.0693433	134.2099361	9.3065665
29	15.8630930	.0630394	148.6409297	9.3696059
30	17.4494023	.0573086	164.4940227	9.4269145
31	19.1943425	.0520987	181.9434250	9.4790132

COMPOUND INTEREST *at 10 per Cent.*

Years.	TAB. XXI. Continu'd. <i>The Amount of l. l.</i>	TAB. XXII. Continu'd. <i>The present Worth of l. l.</i>	TAB. XXIII. Continu'd. <i>The Amount of l. l. Annuity.</i>	TAB. XXIV. Continu'd. <i>The present Worth of l. l. Annuity.</i>
32	21.1137767	.0473624	201.1377674	9.5263756
33	23.2251544	.0430568	222.2515442	9.5694324
34	25.5476699	.0391425	245.4766986	9.6085749
35	28.1024368	.0355841	271.0243685	9.6441590
36	30.9126805	.0323492	299.1268053	9.6765082
37	34.0039486	.0294083	330.0394858	9.7059165
38	37.4043434	.0267349	364.0434344	9.7326514
39	41.1447778	.0243044	401.4477779	9.7569558
40	45.2592556	.0220949	442.5925557	9.7790507
41	49.7851811	.0200863	487.8518112	9.7991370
42	54.7636992	.0182603	537.6369924	9.8173273
43	60.2400692	.0166002	592.4006916	9.8339975
44	66.2640761	.0150911	652.6407608	9.8490887
45	72.8904837	.0137192	718.9048368	9.8628079
46	80.1795321	.0124720	791.7953205	9.8752799
47	88.1974853	.0113382	871.9748526	9.8866181
48	97.0172338	.0103074	960.1723378	9.8969255
49	106.7189572	.0093704	1057.1895716	9.9062959
50	117.3908529	.0085186	1163.9085288	9.9148145
51	129.1299382	.0077441	1281.2993810	9.9225586
52	142.0429320	.0070401	1410.4293198	9.9295987
53	156.2472252	.0064001	1552.4722518	9.9359989
54	171.8719477	.0058183	1708.7194769	9.9418171
55	189.0591425	.0052893	1880.5914247	9.9471065
56	207.9650567	.0048085	2069.6505671	9.9519150
57	228.7615624	.0043714	2277.6156238	9.9562864
58	251.6377186	.0039740	2506.3771862	9.9602603
59	276.8014905	.0036127	2758.0149048	9.9638730
60	304.4816395	.0032843	3034.8163953	9.9671573
61	334.9298035	.0029857	3339.2980349	9.9701430